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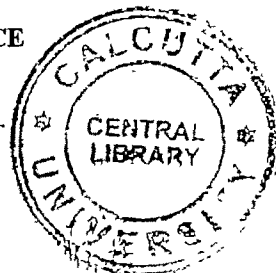
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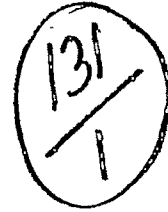
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Trade Sanctions and Child Labour with Endogenous Borrowing Constraint

Sajal Lahiri* and Khalid Mir**

Abstract

We consider a two-period model for two small open economies that are linked via credit markets. In one of the countries, some of the children work in period 1 and thus remain unskilled in period 2. The other country decides optimally the amount of loan that its nationals are allowed to give to the nationals of the first country. In this framework, we examine the effect of trade sanctions on the incidence of child labour. We find that trade sanctions increases the optimal amount of loan, and this mitigates, at the margin, the harmful effects of trade sanctions on child labour.

JEL Classification : O10, O16, F16.

Keywords : Child labour, education, skill, borrowing, lending, trade sanction.

1. Introduction

According to the International Labor Organisation (ILO), there are about 120 million children in the world who work full time and the number goes up to 250 million if one adds part-time child workers (ILO (1996)). Although the overall participation rate has come down quite significantly over the years, the incidence of child labour is still very high among the poor households.¹ Clearly, by working the children are foregoing education and thereby the possibility of escaping poverty when they grow up. Although it is commonly thought that fight against overall poverty will ultimately eliminate child labour, most policy makers believe that urgent actions are needed to address the question in the short run, i.e. direct actions are necessary to reduce the incidence of child labour as soon as possible. For example, it is now a policy goal of the UK's Department for International Development to eliminate child labour from the world by the year 2015.

The important question over which there is no unanimity is how best to address the problem at hand. Furthermore, the issue gets clouded by the fact that protectionist forces in the developed countries often use the presence of child labour to further their own interests, without any considerations for the welfare of children concerned. It is

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¹ The proportion of children under the age of 14 in full-time work which was over 30% in the 1950s, is about 13% now (see Basu (1999)). However, among the poor families, the figure can be as high as 70%.

believed that protectionist forces are trying to introduce 'new' protections as 'old' protections are supposed to be phased out at the auspices of the World Trade Organization (WTO).² As a result a large literature has emerged over the last few years on the economics of child labour.³ The literature is very diverse and in particular examines and compares a number of alternative policy options for the reduction in the incidence of child labour, and these include outright ban on the use of child labour, making basic education compulsory, subsidising basic education, improving the quality of basic education, minimum adult wage legislation, trade sanctions against countries that use child labour etc.

In this paper, we shall reexamine the last of the policy options mentioned above. Under the present WTO agreements, countries are not allowed to impose formal trade sanctions against countries that use child labour, in spite of repeated attempts on the part of the United States of America and the European Union to add 'international labour standards' and 'social clause' to the WTO charter. However, WTO regulations can not prevent unofficial movements led by non-governmental organisations (NGOs) (often funded by protectionist forces) supporting consumer boycotts and putting moral pressures on shops to label products as child labour free. Trade sanctions in these forms are widespread in the developed world.

Ranjan (2000) and Jafarey and Lahiri (2002) examine the effect of trade sanctions on child labour in a two-period model with exogenous borrowing constraint. In Jafarey and Lahiri (2002), there are three main reasons why child labour exists: (i) abject poverty among households, (ii) poor quality of education resulting in low rates of return from basic education,⁴ and (iii) lack of credit opportunities and high level of interest rates.⁵ They isolate three distinct effects from a trade sanction: (i) less income has to be foregone when a child does not work, (ii) less income will be earned when a child does work, and (iii) there will be an upward pressure on the families' discount factor. The first effect would encourage schooling by reducing the attractiveness of child labour; the second would increase poverty, thereby discouraging demand for education. Further, by reducing the current income of child workers, trade sanctions would increase families' demand for loan and thus raise the discount factor (effect (iii)) when the supply of loan is fixed, and this in turn will lower the present value of

² See, for example, Bhagwati (1995), Fields (1994), Maskus and Holman (1996), Rodrik (1996), Srinivasan (1996), and Basu (1999).

³ For the theoretical contributions to the literature see, for example, Jacoby and Skoufias (1997), Basu and Van (1998), Ranjan (1999, 2000), Basu (2000), Baland and Robinson (2000), Chaudhuri (2000), Dessy (2000), and Jafarey and Lahiri (2000, 2002). For empirical works see, for example, Grootaert and Kanbur (1995), Ray (1999, 2000), Ilahi (1999), and Emerson and de Souza (2000). Extensive surveys of the literature can be found in Basu (1999) and Jafarey and Lahiri (2001).

⁴ For evidence, see The Probe Team (1999), Saha and Sarkar (1999) and Drèze and Gandhi Kingdon (2001).

⁵ For evidence, see Besley (1995) and Ray (1998, ch. 14).

returns from education.

In this paper, we shall extend the analysis by Jafarey and Lahiri (2002) by modelling the supply side of loan in a particular way. In particular, we shall consider a two country model where the second country is the provider of loan, but its government decides optimally how much loan its nationals are allowed to give to the families in the first country where child labour exists.⁶ This endogeneity in the amount of loan brings in an additional fourth effect of trade sanctions, and we shall examine if this additional effect reduces child labour.

The lay out of the paper is as follows. The next section sets up the model. Section 3 then examines the effect of trade sanctions on the incidence of child labour. Finally, section 4 concludes.

2. The Framework of Analysis

We consider two small open economies: a 'home' country (h) which is considered to be a developing country and a 'foreign' country (f) which is developed. In each country there is a single household with given endowments of skilled and unskilled workers, denoted by L^h and L^f respectively ($i = h, f$).

There are two periods, indexed by $t = 1, 2$. The number of children in each household in period 1 is exogenously given and these are denoted by N^h and N^f respectively. It is assumed that the household in the developing country determines endogenously the proportion of its children (e^h) that goes to school in period 1, whereas in the developed country all children go to school, i.e. ($e^f = 1$). It is implicitly assumed here that the household in the foreign country faces a higher returns to education than its counterpart in the home country. The children that go to school become skilled workers in period 2; the rest remains unskilled.

Each economy produces two goods in each of the two periods. Goods labelled 1 and 2 are produced in the first time period and goods labelled 3 and 4 in the second. P_i ($i = 1, 2, 3, 4$) represent the prices of the goods. We assume that goods 1 and 3 are 'skilled intensive' whilst goods 2 and 4 are 'unskilled intensive'. We also assume that the home country is a net exporter of the unskilled-intensive good. The price of good 1 is normalised to 1. All the commodity prices are determined in the world market, but are exogenous in our model because of our small open economy assumption.

⁶ Our way of modelling credit is different from the standard treatment of it in the literature such as in Stiglitz and Weiss (1981). As will be seen, the lender-country government's ability to affect the inter-temporal terms of trade in its favour is the key mechanism which enables it to optimally set a quantitative constraint on lending.

Parents' preferences are represented by a utility function that depends on the levels of consumption of the four goods and on the the level of education.⁷ In particular, the utility functions can be explicitly written as :

$$v_i = v_i\left((c'_1, c'_2, c'_3, c'_4) + N' g'(e')\right), \quad i = h, f,$$

where c'_j is the family consumption of good j in country i ($j = 1, 2, 3, 4, i = h, f$) and $N'g'(e')$ represents the utility that the family in country i receives by sending some of the children to school.⁸

The utility function, v , is concave and increasing in its arguments. The subutility function, g , is also concave and increasing. In particular, this implies $g' > 0$ and $g'' < 0$. From the preferences thus defined, we derive the expenditure functions of the household in country i ($i = h, f$) as $E^i\left(1, \theta^i P_2, \frac{P_3}{r_i}, \frac{P_4}{r_i}, U^i - g(e^i)N^i\right)$ where r_i is the discount factor (i.e. one plus the interest rate) in country i . Denoting by E^i_j the partial derivation of E^i with respect to the j th argument, it is well known that E^i_j is the compensated demand for good j in country i and E^i_5 is the reciprocal of marginal utility of income in country i , ($j = 1, 2, 3, 4$) and ($i = h, f$).⁹ We shall define the parameter θ^i later on.

We shall assume positive and decreasing marginal utility of income, i.e.

$$E^i_{j5} \geq 0, E^i_{5j} \geq 0 \quad i = h, f, \text{ and } j = 1, 2, 3, 4 \quad (1)$$

The production side of the two economies in each period can be represented by revenue functions for that period. These are denoted by $R^{1h}(1, \theta^h P_2, L^{1h} + (1 - e^h)N^h, L^{1h})$ and $R^{2h}(P_3, P_4, L^{2h} + (1 - e^h)N^h, L^{2h} + e^h N^h)$ for the home country and $R^{1f}(1, P_2, L^{1f}, L^{1f})$ and $R^{2f}(P_3, P_4, L^{2f}, L^{2f} + N^f)$ for the foreign country, where the superscripts 1 and 2 represent the time periods.¹⁰ Once again, it is well known that the partial derivative of a revenue function with respect to a price gives the output supply of that good and that with respect to the supply of a factor of production gives the price of that factor.¹¹

The inter-temporal budget constraint for the home country can be written as:¹²

$$E^h\left(1, \theta^h P_2, \frac{P_3}{r_h}, \frac{P_4}{r_h}, U^h - g(e^h)N^h\right) = R^{1h} + \frac{R^{2h}}{r_h} \quad (2)$$

⁷ It is to be noted that The Probe Team (1999) found that poor parents in the villages of Northern India think that children should be educated even in the absence of any pecuniary considerations. The inclusion of education in the utility function can also be viewed as an indication of disutility that parents receive from sending their children to work.

⁸ For simplicity, we assume the utility function to be additively separable in the two broad components.

⁹ For these and other properties of expenditure function see, for example, Dixit and Norman (1980).

¹⁰ For defining the revenue functions for the foreign country we have used our assumption that $e^f = 1$.

¹¹ For these and other properties of revenue function see Dixit and Norman (1980).

¹² Since $e^f = 1$, for notational simplicity, we henceforth drop the superscript from the sub-utility function g .

The left hand side is the present value of total expenditure and the right hand side gives the present value of total income for the household in the home country. Having established the budget constraint for the household in the home country, we are now able to discuss the determination of child labour. The household takes all the prices as given and determines e^h by maximising U^h . Setting $\delta U^h / \delta e^h = 0$, we obtain the first child labour equilibrium as:

$$R_j^h = \frac{R_j^{2h} - R_j^{1h}}{r_h} + g'(e^h) E_j^h \quad (3)$$

The left hand side of equation (3) represents the opportunity cost in terms of the loss in unskilled wages in period 1 of an extra unit of education. While the second term on the right hand side represents the pecuniary equivalent of the marginal utility of education, the first term represents the present value of skill premium.

Turning now to the determination of interest rate in the home country, we assume that borrowing is subject to quantitative constraint, or quota, imposed by the foreign country. Denoting by \bar{B} the extent of the quota, the constraint is written as:

$$r_h \bar{B} = R^{2h} - (P_3 E_3^h + P_4 E_4^h) \quad (4)$$

The above equation says that the value of repayment (left hand side) must be equal to the value of excess income over consumption in period 2.

As just mentioned, we assume that the foreign country imposes a quota on the amount of loan that can be given to the home country. This leads to an excess demand for loan in the home country and therefore a wedge between the interest rates in the two countries. Following the treatment of quota in international trade theory literature, we assume that the foreign country government applies competitive loan licensing and thereby collects a quota fee (or, rent) amounting to $(r_h - r_f) \bar{B}$. A reader will immediately realise that our treatment of borrowing constraint is akin to the treatment of voluntary export restraints (VER) in the international trade theory literature. There is an important difference however between the standard treatment of VER in the literature and the way we deal with borrowing constraint here, and this arises because of the dynamic nature of borrowing. In particular, one needs to make some assumption about the time period when the quota rent is actually collected by the government. Since the possible extra rent from lending arises only in period 2 when the loan is repaid, we assume that the government collect the licence fee from the lenders also in period 2, and this quota rent is returned to the household in a lump-sum fashion. With these assumptions, the market clearing condition in the credit market is given by equation (4) and the following equation:

$$\bar{B} = \frac{[P_3 E_3^f + P_4 E_4^f] - [R^{2f} + (r_h - r_f) \bar{B}]}{r_f} \quad (5)$$

The above equation states that the amount of loan given in period 1 (left hand side) must be equal to the present value of excess expenditure over income in the foreign country in period 2.

Finally, the budget constraint for the household in the foreign country is given by:

$$E^f \left(1, \theta^f P_2, \frac{P_3}{r_f}, \frac{P_4}{r_f}, U^f - g(l) N^f \right) = R^{1f} + \frac{R^{2f}}{r_f} + \frac{(r_h - r_f) \bar{B}}{r_f} \quad (6)$$

Note that the last term on the right hand side of (6) is the present value of quota rent that is returned to the household in a lump-sum fashion.

This completes the description of the theoretical framework except for the determination of the optimal level of lending \bar{B} and the definition of the parameter θ' ($i = h, f$). The determination of \bar{B} will be taken up at the end of this section. As for θ' , we shall treat a reduction θ^h as a direct effect of *temporary* trade sanctions against the home country. This is because the home country has been assumed to be an exporter of good 2. We also assume that not all exporters of good 2 in the world market use child labour and therefore the domestic price of good 2 in the foreign country is not affected by trade sanctions, i.e. less imports from the home country is compensated by more imports from other sources. Since θ^f is not affected by trade sanctions, we shall take that $\theta^f = 1$ and denote θ^h simply by θ .

We shall now derive the basic welfare equations which will form the backbone for the subsequent analysis. First of all, taking derivatives of the budget constraints in the two countries (equations (2) and (6)) and making use of the child labour equilibrium condition (equation (3)) and the definition of \bar{B} (equation (4)), we get:

$$E_3^h dU^h = -\frac{\bar{B}}{r_h} dr_h + P_2 (R_2^{1h} - E_2^h) d\theta, \quad (7)$$

$$E_3^f dU^f = \frac{\bar{B}}{r_f} dr_h + \frac{r_h - r_f}{r_f} d\bar{B} \quad (8)$$

Note that de^h does not appear on the right hand side of (7) due to the envelope property. The first terms on the right hand sides of the above two equations give the so-called intertemporal terms-of-trade effects. That is, the lender benefits, and the borrower loses, if the domestic interest rate increases. The second term on the right hand

side of (7) gives the international terms of trade effect of trade sanctions. Since the home country is an exporter of good 2, $R_2^{lh} - E_2^h > 0$ and the home country loses if trade sanctions ($d\theta < 0$) are imposed. The second term on the right hand side of (8) gives the direct effect of an increase in \bar{B} on quota rent.

We conclude this section by deriving the optimal level of lending. This is done by deriving $dU^l = d\bar{B}$ and setting that equal to zero, yielding:¹³

$$\frac{r_h - r_f}{r_h} = \epsilon^h, \quad (9)$$

where the absolute value of the inverse of the elasticity of demand for loan in the home country, ϵ , is given by

$$\epsilon^h = -\frac{dr_h}{d\bar{B}} \cdot \frac{\bar{B}}{r_h}$$

Having fully described the model we shall now move onto the analysis the effect of trade sanctions on child labour in the next section.

3. Trade Sanctions and Child Labour

In order to find the effect of trade sanctions on child labour, differentiating (3), we get :

$$\begin{aligned} \Psi de_h = & P_2 [R_{32}^{lh} - g'E_{32}^h] d\theta - g'E_{33}^h dU^h \\ & + \frac{1}{r_h^2} [R_4^{2h} - R_3^{2h} + g'(E_{33}^h P_3 + E_{34}^h P_4)] dr_h \end{aligned} \quad (10)$$

where $\Psi = \left[g''E_5^h - N(g')^2 E_{33}^h + R_{33}^{lh} + (R_{33}^{2h} - 2R_{34}^{2h} + R_{44}^{2h}) \frac{1}{r_H} \right]$. Note that from

the second order condition for the child labour equilibrium we must have $\Psi < 0$.

The above three effects, as explained in Jafarey and Lahiri (2002), are respectively the positive 'substitution' effect on trade sanction on education level,¹⁴ the positive income effect, and a negative interest rate effect. Trade sanctions reduces the opportunity cost of education and therefore increases participation in education. Increase in real income encourages education, and a higher interest rate discourages

¹³ A reader will immediately see the similarity of this condition with the standard formula for optimal tariffs. The left hand side can be viewed as the implicit ad valorem tax on exports.

¹⁴ It is to be noted that the production side of the model is more general than that in Jafarey and Lahiri (2002), the expression for the substitution effect is somewhat different. In the present case, since good 2 is unskilled intensive, we have $R_{32}^{lh} > 0$.

education. Jafarey and Lahiri (2002) have established that even when the interest rate is exogenous, trade sanctions can increase child labour and that borrowing constraints (i.e. endogenous interest rate) makes it more likely that trade sanctions will increase child labour. In Jafarey and Lahiri (2002) however the level of quota on lending is exogenous and therefore in the present analysis an extra effect via changes in the level of lending induced by trade sanctions is present. In what follows we shall focus on this additional effect.

Differentiating (4), we get :

$$d\bar{B} = \xi dr_h + \frac{N^h}{r_h} \left[(R_1^h - R_2^h) + (P_3 E_{33}^h + P_4 E_{43}^h) g' \right] de^h - \left[P_2 (P_3 E_{32}^h + P_4 E_{42}^h) + P_2 (R_2^h - E_2^h) \left(\frac{P_3 E_{33}^h}{r_h E_3^h} + \frac{P_4 E_{43}^h}{r_h E_4^h} \right) \right] d\theta, \quad (11)$$

where

$$\xi = -\frac{\bar{B}}{r_h} \left(1 - \left(\frac{P_3 E_{33}^h}{r_h E_3^h} + \frac{P_4 E_{43}^h}{r_h E_4^h} \right) \right) + \frac{1}{r_h^3} (P_3^2 E_{33}^h + 2P_3 P_4 E_{34}^h + P_4^2 E_{44}^h) < 0.$$

From (11), we note that $\partial r_h / \partial e^h > 0$ and $\partial r_h / \partial \theta < 0$.

Now, differentiating (9), we get:¹⁵

$$[\varepsilon^h + \varepsilon^f] \frac{d\bar{B}}{d\theta} = \frac{\partial r_h}{\partial \theta} \frac{\bar{B}}{r_h} < 0, \quad (12)$$

where the inverse of the elasticity of supply of loan, ε^f , is given by:

$$\varepsilon^f = \frac{\bar{B}}{r_f} \cdot \frac{dr_f}{d\bar{B}} > 0$$

Since we assume the elasticity of loan demand to be constant, it follows from (9) that trade sanctions must keep the ratio of the two interest rates (r_h/r_f) constant. Since a decrease in θ (trade sanctions) increases r_h for a given level of \bar{B} , it must increase \bar{B} to keep the ratio of the two interest rates constant, given that the loan demand function is negatively, and the loan supply function, positively sloped.

Substituting (7), (11) and (12) into (10), we obtain:

$$\begin{aligned} \left[\psi - M \frac{\partial r_h}{\partial e^h} \right] \frac{de^h}{d\theta} &= \frac{M\bar{B}}{\xi r_h Y} \frac{\partial r_h}{\partial \theta} + M \frac{\partial r_h}{\partial \theta} \\ &+ P_2 \left[R_{32}^h - g' E_{32}^h \right] - g' (R_2^h - E_2^h) P_2 \frac{E_{33}^h}{E_3^h}, \end{aligned} \quad (13)$$

¹⁵ For simplicity, we assume that the elasticity ε^h is constant.

where

$$Y = [\varepsilon^h + \varepsilon^f] > 0,$$

$$M = \frac{1}{r_h^2} [R_4^{2h} - R_3^{2h} + g'(E_{53}^h P_3 + E_{54}^h P_4)] + g' \frac{E_{55}^h \bar{B}}{E_5^h r_h} > 0$$

Only the first term on the right hand side of (13) arises because of the endogeneity of the borrowing quota, and it is clear that this term adds, at the margin, a negative term to the expression of $de^h/d\theta$. That is, because of the endogeneity of the borrowing quota, a decrease in θ at the margin will increase the level of education e^h .

4. Concluding Remarks

In the literature on child labour and in the actual policy arena, a number of alternative and complementary policy prescriptions can be found, and these include trade sanctions, compulsory education, ban on child labour, subsidising education, etc. In this paper we extend the analysis in Jafarey and Lahiri (2002) of the effect of trade sanctions on the incidence of child labour by considering a situation in which poor families are subject to borrowing constraints and the extent of the constraint is optimally decided by the government of the lender country. We find that although trade sanctions can be counter-productive as a policy instrument for the reduction in the incidence of child labour, trade sanctions, in our framework, will in fact relieve the borrowing constraint to some extent and thus mitigate the harmful effects on child labour.

Clearly, our chosen way of endogenising the borrowing constraint is one of many possible ways of doing so. In the history of international capital markets, it has not been uncommon for rich countries to impose capital controls, as it is in the present model. However, most developed countries have now removed such controls to a significant extent. However, many poor countries still find it difficult to raise required capital in the international markets. It will therefore be an important extension of the present analysis to consider a situation when private agents (rather than their government) in the rich countries ration loans given to poor nations with significant incidence of child labour.

References

- Baland, J-M and J. Robinson (2000) : Is child labor inefficient?, *Journal of Political Economy*, 108, 663-679.
- Basu, K. (1999) : Child labor: cause, consequences and cure, with remarks on international labor standards, *Journal of Economic Literature*, 37, 1083-1119.

- Basu, K. (2000) : The intriguing relation between adult minimum wage and child labor, *Economic Journal*, 110, C50-C61.
- Basu, K. and P.H. Van (1998) : The economics of child labor, *American Economic Review*, 88, 412-427.
- Besley, T. (1995) : Savings, credit and insurance, chapter 36 in: J. Behrman and T.N. Srinivasan (eds.), *Handbook of Development Economics, Volume III*, (Amsterdam: Elsevier Science B.V.), pp. 2123-2207.
- Bhagwati, J.N. (1995) : Trade liberalization and 'fair trade' demands: addressing the environment and labor standards issues, *World Economy*, 18.
- Chaudhuri, S. (2000) : Incidence of child labour, free education policy, and trade liberalization in a small open economy: a theoretical analysis, mimeo, Department of Economics, University of Calutta.
- Dessy, S.E. (2000) : A defense of compulsory measures against child labor, *Journal of Development Economics*, 62, 262-275.
- Dixit, A. and V. Norman (1980) : *Theory of international trade*, Cambridge University Press, Cambridge.
- Drèze, J. and G. Gandhi-Kingdon (2001) : School participation in rural India, *Review of Development Economics*, 5, 1-24.
- Emerson, P.M. and A.P.F. de Souza (2000) : *Is there a child labor trap? inter-generational persistence of child labor in Brazil*, Cornell University, Ithaca, USA.
- Fields, G.S. (1994) : Labor standards and international trade, Cornell University.
- Grootaert, C. and R. Kanbur (1995) : Child labor: an economic perspective, *International Labor Review*, 134.
- Ilahi, N. (1999) : *Children's work and schooling: does gender matter? Evidence from the Peru LSMS panel data, Latin America and Caribbean Region*, World Bank, Washington D.C., Processed.
- ILO (1996) : *Economically active populations: estimates and projections, 1950-2010*, International Labor Organization, Geneva.
- Jacoby, H. and E. Skoufias (1997) : Risk, financial markets and human capital in a developing country, *Review of Economic Studies*, 64, 311-335.
- Jafarey, S. and S. Lahiri (2000) : *Food for education and funds for education quality: policy options to reduce child labour*, Discussion Paper No. 00-03, Department of Economics, University of Wales, Swansea.
- Jafarey, S. and S. Lahiri (2001) : Child labour: theory, policy and evidence, *World*

Economics, 2, 69-93.

Jafarey, S. and S. Lahiri (2002) : Will Trade Sanctions Reduce Child Labour? The Role of Credit Markets, forthcoming in the *Journal of Development Economics*.

Maskus, K.E. and J.A. Holman (1996) : *The economics of child labor standards*, Department of Economics, University of Colorado at Boulder.

The Probe team (1999) : *Public report on basic education in India*, Oxford University Press, New Delhi.

Ranjan, P. (1999) : An economic analysis of child labor, *Economic Letters*, 64, 99-105.

Ranjan, P. (2001) : Credit constraints and the phenomenon of child labour, *Journal of Development Economics*, 64, 81-102.

Ray, D. (1998) : *Development Economics*, Princeton University Press, Princeton New Jersey.

Ray, R. (1999) : Poverty, household size and child welfare in India, mimeo, University of Tasmania.

Ray, R. (2000) : The determinants of child labour and child schooling in Ghana, mimeo, University of Tasmania.

Rodrik, D. (1996) : *Labor standards in international trade: do they matter and what do we do about them?*, Policy Essay no. 20, Overseas Development Council, Washington, D.C.

Saha, B. and S. Sarkar (1999) : Schooling, informal experience, and formal sector earnings: a study of Indian workers, *Review of Development Economics*, 3, 187-199.

Srinivasan, T.N. (1996) : International trade and labor standards from an economic perspective, in P. van Dyck and G. Faber (eds.), *Challenges to the New World Trade Organization*, Kluwer Publishers.

Stiglitz, J. and A. Weiss (1981) : Credit rationing in markets with imperfect information, *American Economic Review*, 71, 393-410.

CATASTROPHICAL RISKS

Graciela Chichilnisky*

Abstract

The paper introduces a new decision making tool for choices involving Low probability events with major irreversible consequences. It shows that the Von Neumann Morgenstern axioms do not work well in this context and introduces and develops a new set of axioms that require sensitivity to both small and large probability events. These axioms lead to a different decision theory, which is not based on expected utility analysis. Through a representation theorem it is shown that all the criteria implied by the new axioms have a certain form: a combination of expected utility with a well-defined operator, which can be characterized as a desire to avoid a catastrophe. Practical examples are provided as well as a demonstration of how these axioms help explain the Allais paradox, suggesting new approaches to game theory and the calculus of variations.

JEL Classification : D80, D81, N50.

Keywords : risk, catatrophes, decision making under uncertainty, global, environment, irreversibilities.

1. Catastrophical risk

Global environmental risks such as climate change and rising sea levels are low-probability events with widespread and possibly irreversible consequences. These are fundamentally new risks which are not well understood. Learning through experimentation is out of the question because these risks are effectively irreversible in a time-scale that matters. As a result, classical theories that rely on expected utility (*see Utility theory*) may not work well because they underestimate low-probability events, as discussed below. The need to make global environmental decisions calls for a systematic analysis of choices involving low-probability events with major irreversible consequences. The topic is of current importance but has been neglected in the literature of choice under uncertainty.

This paper introduces a new decision-making tool for such situations. First, it shows why the classical Von Neumann axioms do not work well in this context, as they lead to expected utility that can be insensitive towards small-probability events. Secondly, the entry introduces and develops a new set of axioms that require sensitivity to both large- and small- probability events. These axioms appear to represent ways in which people rationalize the problem of making decisions in situations involving catastrophical risks. The axioms are different from the classic axioms by Von Neumann and Morgenstern, and they lead to a different decision theory which is not based on expected utility analysis. Finally, through a representation theorem, it is shown that all the criteria

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implied by the new axioms have the following form : one term that takes into account the maximization of expected utility, plus a second term which is a well-defined operator that can be interpreted as a desire to avoid a catastrophe. Both parts are present, and both turn out to be important in making decisions under catastrophic risks. This entry provides practical examples of how to use these criteria. It shows how the new axioms help to explain the Allais paradox (see below), which involves choices with low-probability events, and suggests new questions on game theory and on the calculus of variations.

Von Neumann – Morgenstern Axioms

A set of mathematical axioms introduced half a century ago by John Von Neumann and Oscar Morgenstern gave rise to a now classical tool for decision making under uncertainty. Several other mathematicians and economists, such as Harsanyi, Milnor and Arrow, developed related axioms [7]. The axioms formalize the properties of orders defined on sets of uncertain events; the orders are then used to rank or evaluate risky outcomes. The structure of the decision problem is simple. A system with uncertain characteristics is in one of several possible states; each state is the value of a random variable which describes the system. For example, the average temperature of the planet's surface is a state. The system's states can be described by real numbers. For each state $s \in R$ there is an associated outcome; for example, for each temperature level there is an associated vector describing soil fertility and precipitation. Therefore one has $x(s) \in R^N$, $N \geq 1$. When the probabilities associated with each state are given, a description of outcomes across all states is called a *lottery*. (A lottery is also described by the probabilities of each state and the outcomes in each state). A lottery is therefore a function $x: R \rightarrow R^N$, and the space of all lotteries is a function space L .

The Von Neumann—Morgenstern (NM) axioms provide a mathematical formalization of how to rank or order lotteries, i.e. of reasonable ways to order the elements of L . The NM model presumes that the outcomes themselves are ranked; it creates a utility index for the outcomes that is consistent with this ranking and a decision criterion for choice among lotteries. In this sense the NM model does two jobs at once. **Optimization** according to such an order defines a form of decision making under uncertainty used widely until now.

A main result obtained from the NM axioms is a representation theorem: a characterization of all the functionals on L which satisfy the NM axioms. Maximizing such a functional $W: L \rightarrow R$ over a constrained set given by initial conditions defines a form of rational choice under uncertainty. Von Neumann and Morgenstern proved that an order over lotteries which satisfies their axioms admits a representation by an integral operator $W: L \rightarrow R$, which has as a kernel a countably additive measure over the set of states. Such operators are called Von Neumann—Morgenstern utilities, and the

decision procedure obtained by optimizing such utilities is called expected utility maximization, so that

$$W(x) = \int_{s \in R} u(x(s)) d\mu(s) \quad (1)$$

where the real line R is the state—space; the function $x: R \rightarrow R^N$ is a lottery; $u: R^N \rightarrow R$ is a utility function describing the utility provided by the outcome of the lottery in each state s , $u(s)$; and $d\mu(s)$ is a countably additive measure that defines a probability distribution over measurable subsets of states in R . It is standard practice to require that the utility function is bounded to avoid the St Petersburg paradox [2, chapter 3]. The assumption of *bounded utility* is sufficient but not necessary to avoid the St Petersburg paradox. As Bernoulli pointed out, the logarithmic utility function $u(x) = \log(x)$ would deliver a finite expected utility in the context of the St Petersburg paradox. However, we need $p(s)u(x(s))$ to converge to zero as $s \rightarrow \infty$ for the integral to exist. According to the NM representation theorem, a rational choice under uncertainty which satisfies the NM axioms must take the following form: a lottery x is ranked above another y if and only if W assigns to x a larger real number. In symbols

$$x \succ y \Leftrightarrow W(x) > W(y)$$

where W satisfies (1).

The optimization of expected utility is a widely used procedure for evaluating choices under uncertainty. Mathematically, functionals such as W are convenient because they are amenable to a large body of knowledge which goes back several centuries: the calculus of variations. The Euler-Lagrange equations are typically used to characterize optimal solutions. Such mathematical tools are widely used and are valuable to find and describe choices under uncertainty.

Catastrophical Risks

A catastrophical risk is a low-probability event which can lead to major and typically irreversible losses. As already mentioned, global environmental problems have these characteristics (*see Global environmental change*). The classical methods defined above, despite their widespread use, are not satisfactory to evaluate catastrophical risks. The reasons are both practical and theoretical. From the practical point of view, it has been shown that using such criteria undervalues catastrophical risks and hence conflicts with the observed evidence of humans evaluate such risks. For example using NM utilities, the most damaging scenarios of **global warming** induce little if any economic loss. The Intergovernmental Panel on Climate Change (IPCC), the main international scientific organization in this area, recently announced a highly contested figure of about 2% loss of economic value from a doubling of CO_2 concentration in the atmosphere. This is a symptom of a more general phenomenon; a simple computation

shows that the hypothetical disappearance of all irrigation water in the US and all the country's agricultural produce would have at most a 2.5% impact on its gross domestic product. This finding underscores the importance of using appropriate criteria to evaluate catastrophic risks.

Mathematically the problem arises from the fact that the expected utility operator W which emerges from the NM representation theorem (1) is defined with respect to a probability measure μ , which is therefore countably additive. Since the utility function $u: R^N \rightarrow R$ is bounded (i.e. $\sup_{x \in R} |u(x)| < \infty$), the countable additivity of μ can be shown to imply that any two lotteries $x, y \in L$ are ranked by W quite independently of the utility of the outcome in states whose probabilities are lower than some threshold level $\varepsilon > 0$, where ε depends on x and y . To show this formally, introduce the following definition.

Definition 1 A functional $W: L \rightarrow R$ is said to be insensitive to small probability events when

$$\begin{aligned} W(x) > W(y) &\Leftrightarrow \exists \varepsilon > 0 \\ W(x') > W(y') \end{aligned} \quad (2)$$

for all x', y' such that

$x' = x$ and $y' = y$, a.e. on any set

$A: A^C \subset R: \mu(A) < \varepsilon$

The interpretation of this definition is that W ranks x above y if and only if it ranks x' above y' for any pair of lotteries x' and y' which are obtained by modifying arbitrarily x and y in sets of states within a set A with probability lower than ε . Under these conditions one says that the ranking defined by W is insensitive to the outcomes of the lottery in small probability events. The following lemma shows that, as defined by NM, the expected utility criterion W is not well-suited to evaluate catastrophic risks. For simplicity of notation, and without loss of generality, let $N=1$; the same results hold for arbitrary N .

Lemma *Expected utility is insensitive to catastrophic risks.*

Proof The expected utility criterion ranks lotteries in L as follows: $x(s) \succ y(s) \Leftrightarrow \exists$ a measurable and bounded utility function $u: R \rightarrow R$, and a probability measure μ on R :

$$\int_R u(x(s)) d\mu(s) > \int_R u(y(s)) d\mu(s)$$

Now

$$\int_R u(x(s)) d\mu(s) > \int_R \tilde{u}(y(s)) d\mu(s) \Leftrightarrow \exists \delta > 0$$

$$\int_R u(x(s)) d\mu(s) > \int_R u(y(s)) d\mu(s) + \delta$$

Let

$$\varepsilon = \varepsilon(x, y) = \frac{\delta}{6K} \quad (3)$$

where

$$K = \sup_{x \in L, s \in R} |u(x(s))| \quad (4)$$

If

$$x' = x \text{ and } y' = y, \text{ a.e. on } S^C \quad (5)$$

where $\mu(S) < \varepsilon$, then

$$\left| \int_R u(x(s)) d\mu(s) - \int_R u(x'(s)) d\mu(s) \right| < 2K\mu(S) < \frac{\delta}{3}$$

and

$$\left| \int_R u(y(s)) d\mu(s) - \int_R u(y'(s)) d\mu(s) \right| < 2K\mu(S) < \frac{\delta}{3}$$

Therefore

$$\begin{aligned} x \succ y &\Rightarrow \int_R u(x'(s)) d\mu(s) > \int_R u(y'(s)) d\mu(s) \\ &\Rightarrow x' \succ y' \end{aligned}$$

Reciprocally

$$x' \succ y' \Rightarrow x \succ y$$

So that for $\varepsilon = \delta/6K$

$$x \succ y \Leftrightarrow \exists \varepsilon > 0 : x' \succ y' \text{ when } x = x'$$

$$\text{and } y = y' \text{ a.e. on any } S : \mu(S^C) < \varepsilon$$

and therefore by definition the expected utility criterion is insensitive to small probability events.

By the result just established, cost-benefit analysis under uncertainty based on expected utility maximization underestimates the outcomes of small probability events. It is thus biased against certain environmental projects that are designed to prevent catastrophic events. Experimental evidence shows that humans treat choices under uncertainty somewhat differently from what the NM axioms would predict (*see Risk perception*), and it raises questions about the need for alternative axioms which describe more accurately human beings' valuations.

Updating NM

Recently a new set of axioms has been developed which update the NM axioms to correct the bias mentioned against small-probability events. A well defined set of axioms which contrast with the NM axioms was introduced in [4], along with the attendant representation theorems, identifying new types of functionals which are maximized under uncertainty. These axioms parallel similar axioms and criteria for choice over time introduced in [5] and [6]. (See also [8] for an alternative analysis to the NM treatment of decision making under uncertainty that does not provide an axiomatic treatment.)

New Axioms for Choice Under Uncertainty

We propose three axioms for choice under uncertainty, which must be satisfied by the criterion $W : L \rightarrow R$ that is used to evaluate lotteries. The first axiom is satisfied by the expected utility; the other two are not. The first axiom involves linearity and continuity of the criterion with respect to the utility derived from lotteries, where continuity is defined with respect to the sup norm on the space of utility values associated with lotteries L . Formally, the utility values of lotteries L are in the space of measurable and essentially bounded functions on R , with the norm $\|u(x(s))\| = \sup_{s \in L, s \in R} |u(x(s))|$.

Axiom 1 : Continuity of the functional W with respect to its argument, the utility of lottery $u(x)$.

Axiom 2 : Sensitivity to low-probability events. This rules out insensitivity to low-probability events as in the above definition and lemma.

Axiom 3 : Sensitivity to large-probability events. This rules out insensitivity to events of large-probability, as defined below.

Definition 2 A ranking is said to be insensitive to large-probability events when $\forall x, y \exists \varepsilon > 0, \varepsilon(x, y)$ such that

$$W(x) > W(y) \Leftrightarrow W(x') \geq W(y') \quad (6)$$

for all lotteries x', y' such that $x = x', y = y'$, a.e. on S^c , where $\mu(s) > 1 - \varepsilon$. In words, the ranking is the same on any two lotteries x' and y' that are obtained by modifying arbitrarily x and y in any bounded set of states $S \subset R$, which may have an arbitrarily large probability.

Example 1 As an example of a function which is insensitive to large-probability events, consider the space of all continuous linear real-valued functions on L_∞ , the dual of L_∞ , denoted L_∞^* . Within this dual consider a purely finitely additive measure ν on R which assigns measure zero to any bounded set in R , i.e. $\nu(S) = 0$ if $\forall x \in S, |x| < K$, for some $K > 0$. Such measures define functionals satisfying (6). Such functionals are ruled out by Axiom 3, which requires sensitivity to large-probability events. Indeed, such functionals put all the weight on infinity, i.e. on events of arbitrarily small probabilities

according to the countably additive measure μ on R .

A Representation Theorem

Like the NM axioms, the three new axioms presented above lead to a representation theorem establishing the form of every ranking of lotteries that satisfies the three axioms given above. It has been shown [4] that there exist functionals $\Psi: L_\infty \rightarrow R$ which rank all lotteries and satisfy all the axioms. Rather than countably additive kernels, however, these functionals are a convex combination of integral operators with countably additive kernels and purely finitely additive measures, with both elements (countably and finitely additive) nonzero.

Theorem Any ranking \succ of lotteries in $L = L_\infty(R)$ satisfying the three axioms defined above must be of the form

$$x \succ y \Leftrightarrow W(x) > W(y)$$

where $W: L \rightarrow R$

$$W(x) = \lambda \left[\int_R u[x(s)] d\mu(s) \right] + (1 - \lambda) \Phi[u(x(s))] \quad (7)$$

for $\lambda \in (0, 1)$, $u: R \rightarrow R$, μ a probability measure on R , and $\Phi: L \rightarrow R$, $\Phi \in L^* - L_1$ is a purely finitely additive measure.

Proof The proof follows the line of argument presented in [5] and [6]. As defined above, the space of all utility functions derived from lotteries is $L_\infty(R)$ with the sup norm. By Axiom 1, we are looking for an element of the dual space $L_\infty^*(R)$, the space of all continuous linear real-valued functions on $L_\infty(R)$. By standard results in functional analysis, the dual space $L_\infty^*(R)$ consists of $L_1(R)$ as well as another space consisting of purely finitely additive measures, namely continuous linear functions that assign the value zero to any function supported on a bounded set of R . By Axiom 2, the function W is not contained in L_1 , since in that case as shown in the above lemma, Axiom 2 is violated. Axiom 3 implies that W is not a purely finitely additive measure either; as shown in [5] and [6] the only possible form is as represented above.

Remark The connection between the function $W(x)$ and the Prospect theory of Kahneman and Tversky is the subject of another enquiry.

Example 2 As an illustration of the representation theorem presented above, consider the case when the states are discrete, indexed by the integers Z . For each real number μ , $0 < \mu < 1$, a continuous linear functional $\Psi: l_\infty \rightarrow R$ can be defined as follows:

$$\Psi(x) = \mu \sum_{s=1}^{\infty} \lambda^{-s} u(x(s)) + (1 - \mu) \lim_{s \in Z} u(x(s)) \quad (8)$$

where $\lim_{s \in Z} u(x(s))$ is the (Hahn-Banach) extension of the continuous linear limit operator to the space l_∞ of all bounded real-valued functions on Z . The interpretation

of the two parts of the function ψ in (4) is simple. The first part is an integral operator with an integrable kernel $\{\lambda^{-s}\}_{s \in Z}$ which defines a countably additive measure on Z , and therefore emphasizes the weight of large-probability events in the ranking of a lottery $x \in I_\infty$. The second part defines a purely finitely additive measure on Z which assigns positive weight to small-probability events. It defines a measure with 'heavy tails'. Both parts are present, so ψ is sensitive to small- and large-probability events. Catastrophical risks are therefore ranked more realistically by such functionals. The mathematics involved in these representation results is nonlinear analysis, as well as the analysis of convex systems.

Examples and Open Questions

Examples Consider an electrical utility company that seeks. To implement a production and service plan which would be optimal under normal conditions, while at the same time avoiding a potentially catastrophical black-out incident (which could be costly in monetary terms and in human lives). Following our axioms and the above theorem, a typical criterion that would be adopted would involve choosing among all possible plants to maximize the expected throughput plus minimizing the probability of reaching a critical level beyond which there would be a black-out. It can be shown that such a criterion would satisfy our three axioms.

The Allais Paradox The first and perhaps most famous violation of the standard models of choice under uncertainty is due to M. Allais, who presented experimental evidence which is inconsistent with the NM axioms. A variation of this paradox was reported by Kahneman and Tversky. They observed that 82% of the subjects chose a gamble A over another gamble B, and 83% of the subjects chose a gamble C over another gamble D, so that the least 65% chose B and C. However, as shown below, this pair of gambles B and C is inconsistent with the NM model of expected utility.

Example Gamble A consists of a 0.33 chance of winning \$2500, a 0.66 chance of winning \$2400, and a 0.01 chance of winning \$0; while gamble B is a 1.0 chance of winning \$2400. Gamble C consists of a 0.33 chance of winning \$2500, and a 0.67 chance of winning \$0; while gamble D consists of a 0.34 chance of winning \$2400 and a 0.66 chance of winning \$0.

Observe that if an individual prefers B over A, this means that their (sure) utility function u over income satisfies

$$u(2400) > 0.33u(2500) + 0.66u(2400) + 0.01u(0)$$

or

$$0.34u(2400) > 0.33u(2500) + 0.01u(0) \quad (9)$$

the latter of which contradicts a choice in favour of C, because choosing C over D implies

$$0.33u(2500) + 0.67u(0) > 0.34u(2400) + 0.66u(0) \quad (10)$$

One way to resolve this paradox is to understand that, when the new axioms are taken into consideration, the individual's utility function u has two components in cases of small-probability events: one of these components is the expected utility, and the other is focused on the small probability event $u(0)$. Therefore (9) above can be written as

$$0.34u(2400) > 0.33u(2500) + 0.01u(0) - \theta$$

for some real number $\theta > 0$, representing a higher weight given to low (0.01) probability event of winning \$0 than would be the case with expected utility. This implies that

$$0.33u(2500) + 0.67u(0) - \theta < 0.34u(2400) + 0.66u(0)$$

which is no longer inconsistent with (10). With the new axioms, therefore, (9) no longer contradicts (10) and the Allais paradox has been resolved.

Open Questions Risk aversion is typically defined with respect to the utility function which appears inside the expected utility functional (1). Here this definition may not work, and an alternative definition may be needed. An interesting open question is how to define risk aversion for the functionals in (1), which satisfy our axioms.

Another question is how to define repeated game solutions (e.g. Nash equilibrium) that involve players with welfare functions of the forms identified here, and to explore when these solutions exist.

The traditional calculus of variation is based on integral operators that have finite kernels, such as exponential weight functions of the form $e^{-\alpha t}$. This specification no longer holds here, and therefore the optimization of the operators emerging from the new axioms require a new form of calculus of variation. It is of interest that standard tools of the calculus of variations must be redeveloped in new directions. Some results already exist [5, 6], but much work is still needed. The study of optimal solutions of this type of functionals has led to asymptotically autonomous dynamical systems, which occur naturally when one extends the Euler-Lagrange analysis of optimal solutions to encompass the type of operators defined here. Statistical analysis of such systems also requires new tools.

References

- Allais, M. (1988) : The General Theory of Random Choices in Relation to the Invariant Cardinal Utility Function and the Specific Probability Function, in Risk, Decision and Rationality, B. R. Munier, ed., Reidel, Dordrecht, pp. 233-289.
- Arrow, K. (1971) : *Essays in the theory of risk bearing*, North-Holland, Amsterdam.
- Cass, D., Chichilnisky, G & Wu, H. (1996): Individual risks and mutual insurance, *Econometrica* 64, 333-341.

- Chichilnisky, G. (1996) : Updating the Von Neumann Morgenstern axioms for choice under Catastrophic Risks, *workshop on Catastrophic Environmental Risks*, The Fields Institute of Mathematical Studies, University of Toronto, Canada.
- Chichilnisky, G. (1996) : *An axiomatic approach to sustainable development*, Society of choice and welfare 13, 321-357.
- Chichilnisky, G. (1997) : What is sustainable development?, *Land Economics* 73, 467-491.
- Hernstein, N. & Milnor, J. (1953) : An axiomatic approach to measurable utility, *Econometrica* 21, 291-297.
- Machina, M. (1982) : Expected Utility analysis without the independence axiom, *Econometrica* 50, 277-323.
- Machina, M. (1989) : Dynamic consistency and non-expected utility models of choice under uncertainty, *Journal of Economic Literature* XXii, 1622-1668.
- Tversky, A. & Walker, P. (1995) : Risk attitudes and decision weights, *Econometrica* 63, 1225-1280.

On Optimality and Competitive Equilibria in the Presence of Fuzzy Preferences

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Abstract

The paper investigates the validity of the two basic optimality theorems of welfare economics when the preferences of consumers are fuzzy. It is shown that, given certain specific assumptions about the way in which the consumers' choices are determined by their fuzzy preferences and given a very plausible reformulation of the notion of Pareto optimality, one can, indeed, prove the counterparts of the two optimality theorems of welfare economics even when the preferences of consumers are fuzzy.

JEL Classification : D6.

Keywords : fuzzy preferences, competitive equilibrium, optimality.

1. Introduction

The purpose of this paper is to investigate the validity of the two basic optimality theorems of welfare economics¹ when consumers' preferences are fuzzy. The conventional theory of individual choice and preference, especially in economics, usually assumes the agent's preference to be unambiguously given, and, therefore, proceeds to model it as an exact binary relation defined over the set of options under consideration. However, there seems to be increasing realization of the severely restrictive nature of this assumption. In recent years, a large number of writers have sought to extend the conventional theory so as to permit vague preferences formally represented by fuzzy binary relations.² This, of course, has important intuitive and analytical implications for normative economics. Some of these have been explored in the context of social choice theory,³ but, as far as we know, few attempts have been made to study the implications of fuzzy consumers' preferences for the normative properties of competitive market equilibria, which have so profoundly influenced our thinking about the market mechanism. If consumers' preferences are fuzzy, how should one reformulate the crucial notion of Pareto Optimality? In the more general framework of fuzzy preferences, can one prove the counterpart of the 'first fundamental theorem' of welfare

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¹ For classic expositions of these two theorems, see Koopmans (1957) and Debreu (1959).

² See, among others, Orlovsky (1978), Ovchinnikov (1981), Basu (1984), Dutta, Panda and Pattanaik (1986), Switalski (1988), Ovchinnikov and Ozerney (1988), Roubens (1989) and Barrett, Pattanaik and Salles (1990).

³ See, e.g., Nurmi (1981), Leclerc (1984), Tanino (1984) and Barrett, Pattanaik and Salles (1986).

economics, which establishes Pareto Optimality of competitive equilibrium allocations in the absence of externalities? How about the ‘second fundamental theorem’ which shows that, under appropriate assumptions, every Pareto Optimal allocation is achievable through a competitive equilibrium, given suitable specification of property rights? These are normative questions, which arise naturally when one replaces the assumption of exact preferences by the assumption of fuzzy preferences, and which we explore in this paper. We show that, given certain specific assumptions regarding the way in which the consumers’ choices are determined by their fuzzy preferences and given a very plausible reformulation of the traditional notion of Pareto Optimality, one can indeed prove the counterparts of the two basic optimality theorems of welfare economics, even when the consumers’ preferences are fuzzy. To keep the exposition simple, we consider economies without any production. Since fuzzy preferences do not introduce any additional complexity on the production side, the extension of our results to economies with production is straightforward.

In Section 2, we introduce the basic concepts and definitions many of which are familiar from the conventional analysis. Sections 3 and 4 contain our main propositions. We conclude in section 5.

2. The Basic Notation and Definitions

In this section we introduce our basic notation and definitions.

Let Z be a given set. A **fuzzy binary relation** over Z is a function $g: Z^2 \rightarrow [0,1]$. A fuzzy binary relation g over Z satisfies :

- (1) **reflexivity** iff for all $x \in Z$, $g(x,x)=1$;
- (2) **weak connectedness** iff for all distinct $x, y \in Z$, $[g(x,y)>0 \text{ or } g(y,x)>0]$; and
- (3) **positive transitivity** iff for all $x, y, z \in Z$, $[g(x,y)>0 \text{ or } g(y,z)>0]$ implies $[g(x,z)>0]$.

A **pure exchange economy** is described by the following.

- (1) h commodities;
- (2) m consumers, each consumer $i (i=1, \dots, m)$ being characterized by : (i) a consumption set $X_i \subseteq IR_+^h$ (where IR_+ is the set of non-negative real numbers); and (ii) a reflexive and weakly connected fuzzy binary relation R_i over X_i (R_i being interpreted as i ’s fuzzy binary weak preference relation “at least as good as”);
- (3) an aggregate initial endowment bundle $w \in IR^h$.

Note that our definition of a pure exchange economy incorporates the (implicit) assumption that, for every consumer i , R_i is reflexive and weakly connected, but, at

this stage, we do not assume anything about the transitivity of R_i .

A **private ownership pure exchange economy** is a pure exchange economy with the additional specification of initial endowment bundles w_i for all consumers i , such that $w_i \in IR^n$ for all i and $\sum_{i=1}^m w_i = w$.

Throughout this paper, we shall assume that $X_i = IR_+^h$, for all consumers i .

Given a pure exchange economy, an **allocation** is a specification of a consumption bundle for each consumer i . Allocations will be denoted by $a = (x_1, \dots, x_m)$, $a' = (x'_1, \dots, x'_m)$ etc., where x_i, x'_i etc. refer to consumption bundles of i ($i=1, \dots, m$). An allocation $a = (x_1, \dots, x_m)$ is **attainable** iff, for all i , $x_i \in IR_+^h$ and $\sum_{i=1}^m x_i = w$.

Given i 's initial endowment bundle $w_i \in IR_+^h$ and given a price vector $p \in IR^h$ (IR being the set of real numbers), $B_i(p, w_i)$ is defined to be $\{x_i \in IR_+^h | p \cdot x_i \leq p \cdot w_i\}$. $B_i(p, w_i)$ has the obvious interpretation as i 's budget set, given the price vector p and the initial endowment w_i .

Given $p \in IR^h$ and $w_i \in IR_+^h$, let $D_i(p, w_i)$ denote the set of bundles "chosen" by the consumer from the budget set $B_i(p, w_i)$. Note that we allow for the possibility that, for some budget sets $B_i(p, w_i)$, the set of bundles chosen by i from $B_i(p, w_i)$ may be empty.

Given p and w_i , how is $D_i(p, w_i)$ determined? Here one can make several alternative assumptions (see, for example, Orlovsky (1978), Kim (1983), Basu (1984), Dutta, Panda and Pattanaik (1986), Switalski (1988), Ovchinnikov and Ozernoy (1988), Roubens (1989), and Barrett, Pattanaik and Salles (1990)). However, in this paper, we shall consider only three assumptions regarding $D_i(p, w_i)$.

Assumption 2.1 : For all $p \in IR^h$ and all $w_i \in IR_+^h$, $D_i(p, w_i) = \{x_i \in B(p, w_i) | R_i(x_i, x'_i) \geq R_i(x'_i, x_i) \text{ for all } x'_i \in B_i(p, w_i)\}$.

Assumption 2.2 : For all $p \in IR^h$ and all $w_i \in IR_+^h$, $D_i(p, w_i)$ is the set of all $x_i \in B_i(p, w_i)$ such that

$$\min_{x'_i \in B_i(p, w_i) - \{x_i\}} [R_i(x_i, x'_i) - R_i(x'_i, x_i)] \geq \min_{x'_i \in B_i(p, w_i) - \{\hat{x}_i\}} [R_i(\hat{x}_i, x'_i) - R_i(x'_i, \hat{x}_i)] \text{ for all } \hat{x}_i \in X_i.$$

Assumption 2.3 : For all $p \in IR^h$ and all $w_i \in IR_+^h$, $D_i(p, w_i) \supseteq \{x_i \in B_i(p, w_i) | R_i(x_i, x'_i) \geq R_i(x'_i, x_i) \text{ for all } x'_i \in B_i(p, w_i)\}$.

The “pairwise optimality choice rule” implied by assumption 2.1 is discussed in Dutta, Panda and Pattanaik (1986). For a discussion of the max-min difference choice rule underlying Assumption 2.2, the reader may refer to Barrett, Pattanaik and Selles (1990). Finally, note that Assumption 2.2, as well as Assumption 2.1, implies Assumption 2.3.

A **competitive equilibrium** for a private ownership economy is an ordered pair (\bar{p}, \bar{a}) such that: (1) $\bar{p} \in IR^h$ (intuitively, \bar{p} is a price vector); (2) \bar{a} is an attainable allocation; and (3) for all i , $\bar{x}_i \in D_i(\bar{p}, w_i)$.

Given an economy, an allocation \bar{a} is said to be **Pareto Optimal** iff the allocation \bar{a} is attainable and there does not exist any attainable allocation a such that [for all i , $R_i(x_i, \bar{x}_i) \geq R_i(\bar{x}_i, x_i)$] and [for some i , $R_i(x_i, \bar{x}_i) > R_i(\bar{x}_i, x_i)$]. This definition of Pareto Optimality of allocations seems to be a ‘natural’ counterpart of the traditional notion of Pareto Optimality in the non-fuzzy context. Note that, if R_i is assumed to be exact for every consumer i , then the notion of Pareto Optimality defined above coincides with the conventional notion Pareto Optimality.

3. The First Optimality Theorem

We now prove the counterpart of the first optimality theorem of welfare economics when the consumers’ preferences are fuzzy.

Definition 3.1 : For all i , R_i satisfies **strict monotonicity** iff for all $x_i, x'_i \in IR_+^h$, if $[x_i > x'_i]$ then $[R_i(x_i, x'_i) = 1 \text{ and } R_i(x'_i, x_i) = 0]$.

Strict monotonicity of preferences requires that, while comparing a bigger bundle with a smaller one, the consumer is non-ambivalent about his preference and strictly prefers the bigger bundle in the exact sense. While the consumer’s preferences may be vague or ambivalent when the consumer compares two bundles one of which is unambiguously bigger than the other. Further, in such cases, it seems plausible to assume that the bigger bundle will be strictly preferred (in the exact sense) to the smaller bundle.

Theorem 3.2 : *Suppose a private ownership pure exchange economy E is such that for all i , R_i satisfies positive transitivity and strict monotonicity, and Assumption 2.1 holds for every consumer i . Let (\bar{p}, \bar{a}) be a competitive equilibrium for E . Then \bar{a} is Pareto Optimal.*

Proof : Suppose \bar{a} is not Pareto Optimal for E . Since \bar{a} is attainable (given that \bar{a} figures in a competitive equilibrium), there exists an attainable allocation a such that

$$\text{for all } i=1, \dots, m, R_i(x_i, \bar{x}_i) \geq R_i(\bar{x}_i, x_i), \text{ and, for some } i \in \{1, \dots, m\}, \quad (3.1) \\ R_i(x_i, \bar{x}_i) > R_i(\bar{x}_i, x_i).$$

We will show that this leads to a contradiction, which will complete the proof.

First we show that for all $i \in \{1, \dots, m\}$,

$$\text{if } [R_i(x_i, \bar{x}_i) > R_i(\bar{x}_i, x_i)], \text{ then } [\bar{p} \cdot x_i > \bar{p} \cdot \bar{x}_i]. \quad (3.2)$$

and

$$\text{if } [R_i(x_i, \bar{x}_i) \geq R_i(\bar{x}_i, x_i)], \text{ then } [\bar{p} \cdot x_i \geq \bar{p} \cdot \bar{x}_i]. \quad (3.3)$$

Since (\bar{p}, \bar{a}) is a competitive equilibrium, and, since each consumer satisfies Assumption 2.1, for all $i \in \{1, \dots, m\}$, $R_i(\bar{x}_i, \tilde{x}_i) \geq R_i(\tilde{x}_i, \bar{x}_i)$ for all $\tilde{x}_i \in IR_+^h$ such that $\bar{p} \cdot \tilde{x}_i \leq \bar{p} \cdot \bar{x}_i$. (3.2) follows from this. To prove (3.3), assume to the contrary that

$$R_i(x_i, \bar{x}_i) \geq R_i(\bar{x}_i, x_i) \text{ and } \bar{p} \cdot x_i < \bar{p} \cdot \bar{x}_i \quad (3.4)$$

Then consider $\hat{x}_i \in IR_+^h$ such that $\hat{x}_i > x_i$ and $\bar{p} \cdot \hat{x}_i \leq \bar{p} \cdot \bar{x}_i$. Such \hat{x}_i clearly exists. Then by strict monotonicity, $R_i(\hat{x}_i, x_i) = 1$ and $R_i(x_i, \hat{x}_i) = 0$. Note that $\bar{x}_i \in D_i(\bar{p}, w_i)$, and, since $\bar{p} \cdot \hat{x}_i \leq \bar{p} \cdot \bar{x}_i$, $\hat{x}_i \in B_i(\bar{p}, w_i)$. Hence, given that i satisfies Assumption 2.1, $R_i(\bar{x}_i, \hat{x}_i) \geq R_i(\hat{x}_i, \bar{x}_i)$. Given weak connectedness, it follows that $R_i(\bar{x}_i, \hat{x}_i) > 0$. If $R_i(x_i, \bar{x}_i) > 0$, then, noting $R_i(\bar{x}_i, \hat{x}_i) > 0$ and positive transitivity of R_i , we would have $R_i(x_i, \hat{x}_i) > 0$ which is a contradiction. Hence, $R_i(x_i, \bar{x}_i) = 0$. By weak connectedness of R_i , it follows that $R_i(\bar{x}_i, x_i) > 0$. But then $[R_i(\bar{x}_i, x_i) > 0 \text{ and } R_i(x_i, \bar{x}_i) = 0]$ contradict (3.4). This contradiction proves (3.3).

Given (3.1), (3.2) and (3.3),

$$\sum_{i=1}^m \bar{p} \cdot x_i > \sum_{i=1}^m \bar{p} \cdot \bar{x}_i \quad (3.5)$$

By attainability of a and \bar{a} , $\sum_{i=1}^m x_i = \sum_{i=1}^m w_i$ and $\sum_{i=1}^m \bar{x}_i = \sum_{i=1}^m w_i$. Hence $\sum_{i=1}^m x_i = \sum_{i=1}^m \bar{x}_i$,

which implies,

$$\sum_{i=1}^m \bar{p} \cdot x_i = \sum_{i=1}^m \bar{p} \cdot \bar{x}_i \quad (3.6)$$

(3.5) and (3.6) contradict each other, which completes the proof.

Remark 3.3 : The property of positive transitivity of R_i , which plays a crucial role in the proof of Theorem 3.2 is much weaker than the more familiar property of “max-min” transitivity often assumed for fuzzy binary weak preference relations. It may be recalled that R_i satisfies max-min transitivity if and only if, for all $x_i, x'_i, x''_i \in X_i$, $R_i(x_i, x''_i) \geq \min[R_i(x_i, x'_i), R_i(x'_i, x''_i)]$ [for a discussion of various transitivity properties of fuzzy binary relations, see Dasgupta and Deb (1996)].

Remark 3.4 : The standard first optimality theorem of welfare economics follows from Theorem 3.2 as a special case where, for every consumer i , R_i is exact, that is, for all $x_i, x'_i \in X_i$, $[R_i(x_i, x'_i) = 1 \text{ or } R_i(x_i, x'_i) = 0]$.

4. The Second Optimality Theorem

We now turn to the second optimality theorem. First we define some more properties of R_i , which will be used to prove the counterpart of the second optimality theorem in the context of fuzzy preferences.

Definition 4.1 : For all i , R_i is **convex** iff for all $x_i, x'_i, x''_i \in X_i$ and all $\theta \in]0, 1[$,

$$\begin{aligned} [R_i(x'_i, x''_i) \geq R_i(x''_i, x_i) \ \& \ R_i(x'_i, x''_i) \geq R_i(x''_i, x'_i)] \text{ implies} \\ [R_i(\theta x_i + (1-\theta)x'_i, x''_i) \geq R_i(x''_i, \theta x_i + (1-\theta)x'_i)] \end{aligned} \quad (4.1)$$

and

$$\begin{aligned} [R_i(x_i, x''_i) > R_i(x''_i, x_i) \ \& \ R_i(x'_i, x''_i) \geq R_i(x''_i, x'_i)] \text{ implies} \\ [R_i(\theta x_i + (1-\theta)x'_i, x''_i) > R_i(x''_i, \theta x_i + (1-\theta)x'_i)] \end{aligned} \quad (4.2)$$

Definition 4.2 : For all i , R_i is **continuous** iff, for every sequence (x_i) in X_i and all $\bar{x}_i, x_i^0 \in X_i$ such that (x_i) converges to \bar{x}_i ,

if, for all \hat{x}_i in the sequence, $R_i(\hat{x}_i, x_i^0) \geq R_i(x_i^0, \hat{x}_i)$,

$$\text{then } R_i(\bar{x}_i, x_i^0) \geq R_i(x_i^0, \bar{x}_i) \quad (4.3)$$

and

if, for all \hat{x}_i in the sequence, $R_i(x_i^0, \hat{x}_i) \geq R_i(\hat{x}_i, x_i^0)$,

$$\text{then } R_i(x_i^0, \bar{x}_i) \geq R_i(\bar{x}_i, x_i^0) \quad (4.4)$$

Theorem 4.3 : Let E be a pure exchange economy where, for every consumer i , R_i is convex, continuous and strictly monotonic. Let \bar{a} be a Pareto Optimal allocation for E . Then there exists a price vector $\bar{p} \in \mathbb{R}^h$ ($p \neq 0$) which satisfies the following condition : for every i , $\bar{p} \cdot \bar{x}_i \leq \bar{p} \cdot x_i$ for all $x_i \in X_i$ such that $R_i(x_i, \bar{x}_i) \geq R_i(\bar{x}_i, x_i)$. Suppose, given this price vector \bar{p} , there exists $x_i^0 \in X_i$ such that $\bar{p} \cdot x_i^0 < \bar{p} \cdot \bar{x}_i$ for all i . Then there exists $\bar{w}_1, \dots, \bar{w}_m \in \mathbb{R}_+^h$ such that $\bar{w}_1 + \dots + \bar{w}_m = w$, and, if every consumer i satisfies Assumption 2.3, then (\bar{p}, \bar{a}) is a competitive equilibrium for the private ownership economy \hat{E} that we get from E when the initial endowment bundles of the consumers are specified to be $\bar{w}_1, \dots, \bar{w}_m$ respectively.

Proof : Let $\bar{x} = \sum_{i=1}^m \bar{x}_i$. Let $G = \{x \in \mathbb{R}_+^h \mid x = \sum_{i=1}^m x_i \text{ for some } x_1, \dots, x_m \text{ such that, for all } i, R_i(x_i, \bar{x}_i) \geq R_i(\bar{x}_i, x_i) \text{ and, for some } i, R_i(x_i, \bar{x}_i) > R_i(\bar{x}_i, x_i)\}$. Noting R_i is strictly monotonic and convex, it can be easily checked that G is nonempty and convex. We now show that \bar{x} must be on the boundary of G .

Suppose \bar{x} lies in the interior of G . Note that by the definition of G and Pareto Optimality of \bar{a} , \bar{x} cannot be an element of G . Since $\bar{x} \notin G$, if \bar{x} lies in the interior of G , then it can easily be checked that G cannot be convex, which is a contradiction. Thus \bar{x} cannot be in the interior of G . Now suppose \bar{x} is in the interior of $\mathbb{R}_+^h - G$. Then there exists a neighbourhood J of \bar{x} such that $J \subseteq [\mathbb{R}_+^h - G]$. Hence one can find $x' \in [\mathbb{R}_+^h - G]$ such that $x' > \bar{x}$. Then it is clear that, for some x'_1, \dots, x'_m , $\sum_{i=1}^m x'_i = x'$, and, for all i , $x'_i > \bar{x}_i$. Then, by strict monotonicity, $R_i(x'_i, \bar{x}_i) > R_i(\bar{x}_i, x'_i)$ for every consumer i . In that case, $x' \in G$ which contradicts our assumption that

$x' \in [IR_+^h - G]$. Thus \bar{x} is neither in the interior of G nor in the interior of $IR_+^h - G$. Hence \bar{x} is on the boundary of G .

Since G is nonempty and convex and \bar{x} is on the boundary of G , there exists a hyperplane H with normal \bar{p} ($\bar{p} \neq 0$) such that G lies in the upper halfspace defined by H and \bar{x} lies on H (see Lemma B.1.2 of Karlin (1959)).

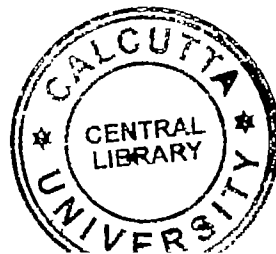
Next, we show that for all i and all $x_i \in X_i$,

$$\text{if } [R_i(x_i, \bar{x}_i) \geq R_i(\bar{x}_i, x_i)] \text{ then } \bar{p} \cdot x_i \geq \bar{p} \cdot \bar{x}_i \quad (4.5)$$

Consider $x = \bar{x}_1 + \bar{x}_2 + \dots + \bar{x}_{i-1} + x_i + \bar{x}_{i+1} + \dots + \bar{x}_m$. We first show that x cannot be below H . Suppose x is below H . Then consider $\hat{x} \in G$. Let $\tilde{x} = \theta \hat{x} + (1 - \theta)x$ where $0 < \theta < 1$. Since $\hat{x} \in G$, $\hat{x} = \sum_{i=1}^m \hat{x}_i$ for some \hat{x}_i ($i=1, \dots, m$) such that for all i , $R_i(\hat{x}_i, \bar{x}_i) \geq R_i(\bar{x}_i, \hat{x}_i)$, and, for some i , $R_i(\hat{x}_i, \bar{x}_i) > R_i(\bar{x}_i, \hat{x}_i)$. Then, note that, by convexity of R_i ($i=1, \dots, m$), $R_i(\theta \hat{x}_i + (1 - \theta)x_i, \bar{x}_i) \geq R_i(\bar{x}_i, \theta \hat{x}_i + (1 - \theta)x_i)$ for all i and $R_i(\theta \hat{x}_i + (1 - \theta)x_i, \bar{x}_i) > R_i(\bar{x}_i, \theta \hat{x}_i + (1 - \theta)x_i)$ for some i . Also, it is clear that $\tilde{x} = \sum_{i=1}^m [\theta \hat{x}_i + (1 - \theta)x_i]$. Hence \tilde{x} belongs to G . Taking θ arbitrarily close to 0, \tilde{x} can be made arbitrarily close to x and hence \tilde{x} can be made to lie below H . Since $\tilde{x} \in G$ and G lies in the upper halfspace defined by H , this is a contradiction. Thus x cannot be below H . Hence, noting $\bar{x} \in H$, $\bar{p} \cdot x \geq \bar{p} \cdot \bar{x}$. Therefore $\bar{p} \cdot x_i \geq \bar{p} \cdot \bar{x}_i$. This proves (4.5).

Now suppose, for every i , there exists $x_i^0 \in X_i$ such that $\bar{p} \cdot x_i^0 < \bar{p} \cdot \bar{x}_i$. Then consider any given i and any given $\underline{x}_i \in X_i$ such that $\bar{p} \cdot \bar{x}_i \geq \bar{p} \cdot \underline{x}_i$. Then let $\underline{x}_i = \theta x_i^0 + (1 - \theta)\underline{x}_i$, where $0 < \theta < 1$. Clearly, $\bar{p} \cdot \underline{x}_i < \bar{p} \cdot \bar{x}_i$, and hence, by (4.5), $R_i(\bar{x}_i, \underline{x}_i) > R_i(\underline{x}_i, \bar{x}_i)$. Since this is true of every θ such that $0 < \theta < 1$, by continuity of R_i , it follows that $R_i(\bar{x}_i, \underline{x}_i) \geq R_i(\underline{x}_i, \bar{x}_i)$. Thus, for all $\underline{x}_i \in X_i$,

$$\text{if } \bar{p} \cdot \bar{x}_i \geq \bar{p} \cdot \underline{x}_i, \text{ then } R_i(\bar{x}_i, \underline{x}_i) \geq R_i(\underline{x}_i, \bar{x}_i) \quad (4.6)$$



Now consider any $\bar{w}_1, \dots, \bar{w}_m \in \mathbb{R}_+^h$ such that $\bar{p} \cdot \bar{w}_i = \bar{p} \cdot \bar{x}_i$ for all i . Since $\bar{p} \cdot (\bar{w}_1 + \dots + \bar{w}_m) = \bar{p} \cdot \bar{w} = \bar{p} \cdot \bar{x}$, clearly, such $\bar{w}_1, \dots, \bar{w}_m$ can be found. Then by (4.6), for all $x_i \in B_i(\bar{p}, \bar{w}_i)$, $R_i(\bar{x}_i, x_i) \geq R_i(x_i, \bar{x}_i)$, and hence $\bar{x}_i \in D_i(\bar{p}, \bar{w}_i)$ by Assumption 2.3. Therefore (\bar{p}, \bar{a}) constitutes a competitive equilibrium for the private ownership economy defined by E and $(\bar{w}_1, \dots, \bar{w}_m)$.

Remark 4.4 : Theorem 4.3 does not assume either positive transitivity or any other form of transitivity for the fuzzy binary weak preference relations R_i .

Remark 4.5 : By assuming that R_i is exact for every consumer i , from Theorem 4.3, one can derive, as a corollary, a version of the conventional second optimality theorem of welfare economics. In view of Remark 4.4, this may seem somewhat surprising, since, in the usual proof of the familiar second optimality theorem, one assumes that the (exact) weak preference relation of every consumer is transitive. However, it is easy to check that, in the proof of the conventional second optimality theorem, one can dispense with the transitivity of (exact) preferences if one uses a somewhat stronger version of the usual convexity property of exact preferences.

5. Concluding Remarks

In this paper, we have proved the counterparts of the two basic optimality theorems of welfare economics in a framework where consumers' preferences are fuzzy. As we have remarked earlier, the two propositions in this paper constitute generalizations of the two traditional optimality theorems with exact preferences. It may be worth highlighting one aspect of our results. The notion of a competitive equilibrium must have, implicit in it, a rule of consumers' behaviour, linking the consumer's choice to his preferences. While the rule of behaviour is obvious when the consumer's preferences happen to be an exact ordering ("choose an available alternative which is at least as good as every alternative in the exact sense"), there is no such obvious rule of behaviour when the consumers' preferences are fuzzy. Our Assumptions 2.1 and 2.3, figuring, respectively, in our Theorems 3.2 and 4.3, are only two possible behavioural assumptions that one can make in this context. While these behavioural assumptions are plausible, one can also think of other plausible behavioural rules. Further investigation is necessary to check the validity of the optimality theorems under these other assumptions about the way in which consumers' choices are determined by their (fuzzy) preferences. Finally note that, while, in this paper, we have used the more usual "numerical" version of the fuzzy framework, our analysis can be readily transferred to the purely 'ordinal' frameworks of Goguen's (1967) 'L-fuzzy sets' and Basu, Deb and Pattanaik's (1992) 'soft sets'.

References

- Barrett, C.R., P.K. Pattanaik and M. Salles (1986) : On the structure of fuzzy social welfare functions, *Fuzzy Sets and Systems*, Vol. 19, pp. 1-10.
- Barrett, C.R., P.K. Pattanaik and M. Salles (1990) : On choosing rationally when preferences are fuzzy, *Fuzzy Sets and Systems*, Vol. 34, pp. 197-212.
- Basu. K. (1984) : Fuzzy revealed preference theory, *Journal of Economic Theory*, Vol.32, pp. 212-227.
- Basu. K., R. Deb and P. K. Pattanaik (1992) : Soft sets : an ordinal formulation of vagueness with some applications to the theory of choice, *Fuzzy Sets and Systems*, Vol. 45, pp. 45-58.
- Dasgupta. M. and R. Deb (1996) : Transitivity and fuzzy preferences, *Social Choice and Welfare*, Vol. 13, pp. 305-318.
- Debreu. G. (1959) : *Theory of value*, John Wiley and Sons, Inc., New York.
- Dutta. B., S. Panda and P. K. Pattanaik (1986) : Exact choice and fuzzy preferences, *Mathematical social sciences*, Vol. II, pp. 53-68.
- Goguen. J. A. (1967) : L-fuzzy sets, *Journal of Mathematical Analysis and Applications*, Vol.18, pp. 145-174.
- Karlin. S. (1959) : Mathematical Methods and Theory in Games, Programming and Economics, *Addison-Wesley Publishing Company, Reading, Mass.*.
- Kim. J. B. (1983) : Fuzzy rational choice functions, *Fuzzy Sets and Systems*, Vol.10.
- Koopman. T. (1957) : Three essays on the state of economic science, *Mcgraw-Hill Book Company, New York*.
- Leclerc. B. (1981) : Efficient and binary consensus functions and transitively valued relations, *Mathematical Social Sciences*, Vol.6, pp.249-259.
- Nurmi. H. (1981) : Approaches to collective decision making with fuzzy preference relations, *Fuzzy Sets and Systems*, Vol.6, pp.249-259.
- Orlovski. S. A. (1978) : Decision making with a fuzzy preference relations, *Fuzzy Sets and Systems*, Vol.1, pp.155-167.
- Ovchinnikov. S. N. (1981) : Structure of fuzzy binary relations, *Fuzzy Sets and Systems*, Vol.6, pp.169-195.
- Ovchinnikov. S. N. and V. M. Ozernoy (1988) : Using fuzzy binary relations for identifying noninferior decisions alternatives, in J. Kacprzyk and M. Roubens (eds.), *Nonconventional Preference Relations in Decision Making*, Springer Verlag, Berlin.
- Roubens. M. (1989) : Some properties of choice functions based on valued binary relations, *European Journal of Operations Research*, Vol.40, pp.309-321.
- Switalsky. Z. (1988) : Choice functions associated with fuzzy reference relations, in J.Kacprzyk and M. Roubens (eds.), *Nonconventional Preference Relations in Decision Making*, Springer Verlag, Berlin.
- Tanino. T. (1984) : Fuzzy preference ordering in group decision making, *Fuzzy Sets and Systems*, Vol.12, pp.117-131.

The Mutuality of Private and Public Credit : the Rise and Decline of Public Credit

Amiya Kumar Bagchi*

Abstract

This essay deals with the issue of the rise of the public credit system across space over the last four centuries and its recent decline in the last two decades. It highlights how the capitalist system and the public credit system reinforce each other, the former offering loans in times of distress, and the latter rendering its fiduciary responsibility. The paper contends that the switch from the fixed exchange rate regime to its flexible counterpart signals the fall of the public credit system that gathers momentum during the Reagan regime in the 1980's, culminating in the Bush (Junior) administration. The same trend takes off during the Rajiv Gandhi regime in India, speeds up in the early 1990's reaching its peak in the current BJP led administration.

JEL Classification : E44, E62, F20, N20.

1997

Keywords : public credit, private credit, financial system, stock market, global capitalism.

1. The first moment

What is the relationship between the state of public credit and the health of the financial system, including banks and stock markets? This relationship has varied across countries and over time. But a preliminary answer to this question and other questions naturally arising out of it may be sought by looking at some of the high points in the evolution of this relationship across the centuries that have operated on it. There were two defining moments in the rise of state-backed banks, namely, the foundation of the Bank of Amsterdam in 1609, and that of the Bank of England in 1694. These were also the moments of the rise of bank-backed public credit. The situations in the two years were apparently different: in 1609 the Netherlands had emerged from more than a quarter-century of war with the Spanish emperor, and was beginning twelve years of peace. But hostilities were resumed in 1621 and peace and the recognition of the independence of the Netherlands came only in 1648. The Bank of England was founded in 1694 in the midst of an expensive war with France. But there are great similarities between the two founding events as well. In both cases, the new bank was backed by the wealth of an emerging class of merchants and financiers.

The Bank of Amsterdam was itself based on the model of the Venetian Banco della Piassa di Rialto, founded in 1587 (De Vries and Van der Woude, 1997, p.131). The function of the bank was apparently conceived in very conservative ways (Van der Wee, 1977). It was primarily a bank of deposit of coin which it standardized. Mer-

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chants were also required to exchange all bills of exchange only through the bank. But throughout the seventeenth century the bank kept 90 per cent of its deposit liabilities in cash. However, the effective standardization of coinage and the certainty of receiving payment in due time made it an international bank through a very large part of the clearing of international obligations taking place. The bank lent only to the city of Amsterdam and the Dutch East India Company, both of which were rich clients in the Dutch Golden Age.

As the Dutch became embroiled in almost continuous hostilities in the seventeenth century, the state needed extraordinary finance when the actual military conflict escalated. This money was raised by taxes, but was supplemented by heavy borrowing in the years of war. Holland was the most important of the seven provinces of the Netherlands, and hence its debt can be taken as indicative of the course of public debt in that country. Its debt together with that of the Generality (which may be regarded as the federal arm of the Dutch state) rose from about 28 million guilders in 1609 to about 143 million in 1647, at the end of the hostilities with Spain. In the years of relative peace (their brief naval wars with England in between) between 1648 and 1672, the Dutch managed to reduce the rate of interest on government loans to 4 per cent (from rates varying between 6.25 to 16.67 per cent for different kinds of loans, in the beginning of the century. Holland was also able to move to a system under which the state loans could be irredeemable, and the state would guarantee only to pay the interest on the loan (De Vries and Van der Woude, 1997, p.115). But, of course, a secondary market developed in such loans. The level of borrowing during the wars of 1621-48 came to 40 per cent of the taxes. There was a steep acceleration in the growth of the public debt between the 1680s and the peace of 1713, when the Dutch fought against the French in alliance with the English, and the Dutch public debt reached more than 300 million guilders. The tax burden of the Dutch increased steeply, and Holland's excellent credit began to be called into question. Moreover, the Dutch economy began its long stagnation, a stagnation that was probably exacerbated by the increase in the inequality of wealth, itself partly fuelled by the accumulation of public bonds among a small coterie of merchant oligarchs. (This was a contrast with the initial years of the Republic when many small traders and artisans and women figured in large numbers among the creditors of the state). This was a demonstration that credit institutions can supplement a nation's resources in emergencies, but the public credit would not stand up indefinitely against an ever-increasing demand on it when it is not matched by economic growth or discipline on the part of the wealthy in service of the common weal.

2. The second moment

The second and perhaps the more vital momentous moment in the linking up of private and public credit occurred when the Bank of England was founded in 1694, in explicit emulation of the Bank of Amsterdam, but with several novel features. William

of Orange had been invited by the English to be their monarch and Dutch William not only cemented the alliance of England and the Netherlands but also introduced many innovations of the Dutch into the English financial system. However, the initiatives for many of the innovations came not from the government but financiers who were close to the government. The government was always pressed for money, and initially had to pay high rates of interest to raise its loans. In 1694, William Paterson, a Scots financier proposed the establishment of the Bank of England with a capital of £1.2 million. The capital would be lent to the government at 8 per cent rate of interest. In return The bank was incorporated by a charter, since there was no provision for granting limited liability to joint-stock companies at that date: initially, it was allowed to receive deposits from the public, and lend money to them. More importantly, it performed the function of paymaster for the government, including the function of transferring money to the armies of war across the Channel. Discounting Treasury or Exchequer bills, bills of exchange. In 1697 when the charter was renewed, the Bank of England formally obtained the right of note issue: these notes could be used within England to pay public dues, and the Bank of England enjoyed a monopoly in this respect (Dickson, 1967, chapters 3 and 4; Dickson and Sperling, 1970; Van der Wee, 1977). The government continued to be short of funds as the war continued. Against considerable opposition, it chartered a New East India Company in 1698, in return for a loan of £2 million; in 1709, it allowed the two East India Companies to merge in return for a loan of £1.2 million from the United company. 'In 1711, Godolphin's successor, [Robert] Harley', arranged for the owners of £9 m. of short-term debts which the government could not immediately pay off, to be incorporated as "The Governor and Merchants of Great Britain trading to the South Seas". The holder of securities received an equivalent sum in South Sea Company stock, and the money market was thus freed at a stroke from a large floating debt, even though the former discount on short-term securities was transferred to the new stock, which only reached par in 1715" (Dickson and Sperling, 1970, p.288). The South Sea Company was easily the biggest Joint-stock company in its brief career and was explicitly conceived as a tool of imperialist aggression: the hope was to break into the monopoly of trade that Spain tried to maintain with its colonies in the western hemisphere, with armed raids if need be. This hope was not fulfilled. The South Sea Company, however, was granted an *asiento* that allowed it to import slaves from Africa and export them to the Spanish colonies. The English emerged as the biggest slave-traders of all in the eighteenth century, but not through the instrumentality of the South Sea Company. The latter collapsed because of speculation in its shares following another scheme, legalised in 1720 to consolidate all the debt of the English government as its expanded capital, and unprincipled appropriation of short-term capital gains by the

¹ Godolphin and Harley acted basically as the prime ministers and finance ministers of the British government although they were not so designated officially.

promoters of that scheme through insider trading and issue of new shares of the company. The chief culprits were severely punished and the South Sea Company became a holding company for the public debt of England.

The bursting of the South Sea bubble, however, did not seriously hinder the 'funding' of short-term debts into cheaper and virtually irredeemable long-term debt which remained an enduring English practice and a contribution to the evolution of public credit world-wide. However, the innovation of 'funding' alone would not have allowed England to win in competition with France for supremacy in Europe and eventually over the whole world. The ability of the English state to tax its subjects so as to service its increasing public debt, and the rise in economic prosperity caused by the industrial revolution also played a crucial part (for the role of taxation in powering the English upsurge, see O'Brien, 1988; Brewer, 1989 and O'Brien, 1994). The tax revenues of the English government increased from less than £2 million before the Nine Years War starting in 1689 to £12 million by the time of the American War of 1776-83. The French with its absolutist regime was far less successful in taxing its subjects. Already by the first quarter of the eighteenth century, Englishmen were paying 17.6 livres per head annually in taxes whereas a Frenchman was paying only 8.1 livres; by the 1780s, the Englishman was paying 46 livres as annual tax whereas the Frenchman was paying only 17 livres (Brewer, 1989, pp.89-90). One major reason for the English success was that the increased taxes were not obviously regressive. During the Napoleonic war the British government introduced also an income tax with a degree of progressivity. Behind the amazing record of tax compliance in Britain were also these factors of equity in statecraft even under an oligarchic regime.

3. The centrality of New York (and Washington): uses of public credit by the US state

We now skip two centuries and turn to the way public and private credit evolved under the surveillance and moral preaching of Washington and the pundits on Wall Street. From the end of the Second World War, the USA emerged as the largest economy and the most powerful state in the world. In all the countries outside the socialist bloc, the US state and its allies, and the two major institutions set up by the Bretton Woods agreement, namely, the IMF and the IBRD acted as the monitors of global capitalism. From the 1970s, after the breakdown of the system of fixed exchange rates, the US state emerged singly as the centre for absorbing much of the floating savings of the major capitalist countries. Thus US public credit came to assume the character of the global public credit system of the capitalist world.

Throughout most of the period, the US state continued to expand: it absorbed a much larger proportion of national resources than ever before, and it used both increased taxes and loans to finance its expenditures. The stance of the state regarding the relative dependence on taxes, especially, taxes on the rich changed from the time

of Reagan's presidency, when it was decided that the rich would deliver more savings if they were taxed less. The rich have yet to deliver on that promise but George W. Bush has continued with the governmental indulgence of the rich.

One of the paradoxes of the ideology of the minimalist state embraced by the US government was that even as the Reagan administration was trumpeting this ideology under its patronage governmental expenditure reached new heights. The fiscal exhilaration of the state was balanced in a classic demonstration of the Mundell-Fleming assignment rules by monetary stringency. As the fiscal deficit rose, it was financed by loans, and they were advanced not only by the Americans but also by the Germans and the Japanese. The US dollar became grossly overvalued and as the budget deficit rose, so did the current account deficit. Even the Plaza Accord of 1985, and the devaluation of the US dollar against the other hard currencies did not lead at once to the correction of that deficit: Table 1 reproduces the series of current account deficits and other relevant data of the US balance of payments since 1985. The Black Friday of October 1987 had that fiscal exhilaration and current account deficit as its background.

Table 1 US current account deficit and foreign investment 1985-2000
(US \$ billion)

Year	Current account	Direct investment in the USA	Direct investment abroad	Assets	Liabilities	Invest- ment income credit	Invest- ment income debit
1985	-121.79	220.00	386.35	-7.50	76.04	NA	NA
1986	-147.54	272.97	530.07	-4.27	85.78	NA	NA
1987	-163.45	316.20	590.25	-5.25	66.93	NA	NA
1988	-121.25	391.53	692.46	-7.98	73.85	NA	NA
1989	-99.50	534.73	832.46	-22.08	95.72	NA	NA
1990	-78.96	539.60	731.46	-28.77	22.01	NA	NA
1991	-8.32	669.14	827.54	-45.68	57.54	NA	NA
1992	-66.38	694.21	798.63	-49.17	71.98	NA	NA
1993	-82.48	51.38	-83.95	-146.25	111.00	132.77	-105.13
1994	-118.20	46.13	-80.18	-60.31	139.41	163.89	-142.80
1995	-109.29	57.80	-98.78	-122.51	237.48	209.76	-184.71
1996	-120.94	86.52	-91.88	-149.83	367.73	224.10	-198.57
1997	-139.82	105.59	-104.82	-118.98	385.61	258.78	-245.18
1998	-217.41	178.20	-142.51	-136.13	269.35	257.33	-258.51
1999	-324.39	301.02	-153.41	-131.22	354.75	283.10	-291.62
2000	-444.69	287.68	-152.44	-124.94	474.59	350.55	-360.17

Source: IMF: *Balance of Payments Yearbook*, 1993, 2001.

Note: 'Assets' and 'Liabilities' refer to portfolio investment, the former indicating US portfolio investment abroad and the latter to investment by foreigners in the USA.

The US current account deficit narrowed until 1991. But it began increasing again after that year. This time around, it was not the public sector deficit which was the main culprit. The public sector deficit came down and began showing a surplus, but the private sector borrowed more and invested more abroad. The US direct private investment abroad was higher than inward direct foreign investment until 1996 and then foreigners began to invest at a higher rate in the USA than the US citizens and corporations invested abroad. The US portfolio investment abroad was a relatively small figure until 1990, but then it began increasing, and from 1995 it has always exceeded more than \$100 billion, but without a clear trend. On the other hand foreign portfolio investment in the USA has shown a strong upward trend, from 1989, rising from \$71.98 billion in that year to \$474.59 billion in 2000 (Table 1). The result of all this has been that from 1998, the US has earned less from its investments abroad than the foreign investors took away from the country (Table 1). In spite of all this, however, not only did foreign lenders continue to buy US Treasury bonds in ever larger amounts but the US investors also poured ever-increasing amounts of money into the stock market. There was a genuine increase in productivity caused by the breathlessly rapid flow of innovations from information technology entrepreneurs, but the so-called independent investment analysts also egged them on, sometimes privately expressing complete cynicism about their own advice (The whole experience puts another nail on the coffin of the claim that putting equity-holders as the sole controllers of firms is the best way of tackling principal-agent dissonance in information and resulting control). One of the features of this boom is what the *Forbes* Magazine has called an 'IPO bubble bath': In the 1990s initial public offerings in the US stock market numbered 4567. They were talked up and snapped up astronomical premia on the offer price Cisco shares were priced at 60,614 per cent on the offer price, VA Linux was selling at 698 per cent premium on the first day, and so on. Unfortunately one-fifth of these offerings declined by more than 90 per cent compared with their offer price. As a result of this experience of the investors, by the beginning of 2002, new shares were traded at more than 30 per cent discount on their offer price (www.Forbes.com/ipodata).

Miller, Weller and Zhang (2002) have pointed to another factor which raised stock values to higher levels than was warranted by their fundamental values. They derive a formula for the fundamental value of a share:

$$V^F(D) = D / (r - \mu + \pi)$$

where $V^F(D)$ is the expected value of a share which pays dividends at the rate $D(t)dt$, r is the risk-free rate of interest, the expected rate of growth dividends is μ and π is the risk premium.

Suppose that without effective intervention by the authorities, dividends are subject to jumps that arrive uniformly and independently over time, so that the probability of arrival of jumps can be described as a Poisson distribution. If λ is the mean number of jumps per unit time, and θ is a measure of the (dis)comfort of the average (representative) shareholder produced by a(n) (un)favourable jump in dividends, then the fundamental value of the share changes to:

$$V^F(D) = D / (r - \mu + \pi + \lambda\theta)$$

If, however, the representative shareholder believes that the authorities will not try to put a cap on the upward movement of dividends or share prices but can always stop any adverse movements, then effectively a ratchet operates to alter the movement of $V^F(D)$. Miller et al. show that the new trend line of the shareholder's expected value of shares will always lie above the 'true' trend line even in cases in which shareholders have a positive but not a certain belief in the ability of the authorities to direct share values in a favourable manner. They attribute the generation of such a belief among US shareholders to their faith in the maestro, the chairman of Federal Reserve Board, Alan Greenspan, to be always able to find the right policy mix to justify their faith (cf. Anantha-Nageswaran, 2002 and Woodward, 2001).

The confidence in Greenspan springs from the fact that he took prompt action after the crash of 1987, cutting interest rates and pumping in liquidity. He took similar action in 1998, when the money and capital markets were suffering from a liquidity crunch. However, Greenspan's magic has failed to work since the collapse of the NASDAQ boom. Repeated cuts in interest rates have failed to stimulate the US economy in spite of the predictions of the official think tanks.

I will not get into the issue of the way US and G7 policies as orchestrated by the IMF, the World Bank and the WTO have led to global impoverishment and created a global effective demand problem (cf. Bagchi, 1992). I will here point to the problems of fundamental imbalances in the US economy itself that have been created by misuse of both public and private credit by the US financiers and the US government respectively. First of all, take the massive mis-accounting ('creative accounting') practised by so many major firms. Apart from the revelations of misdeeds of Enron, WorldCom, Xerox, Merrill Lynch and many other corporations as revealed by various investigations, the Standard & Poor's index of profits of the top 500 have shown an increasing upward deviation since 1998, from the index of corporate profits as computed in national income statistics (Anantha-Nageswaran, 2002).

I have already pointed to the large and increasing current account deficits since 1992. Under the pressure of a Republican-dominated Congress, the government budget deficits turned into a surplus, and by the year 2000, the government budget surplus amounted to \$254.4 billion. But the current account deficit that year was \$444.69.

Thus the US private sector drew on the savings of the rest of the world for an amount which is about 50 per cent larger than the national income of India (it would come to more than 6 per cent of the US GDP of \$9963.1 billion in 2000, and an even larger percentage of its net national income of \$8701.6 billion (All these figures have been taken from IMF: **International Financial Statistics Yearbook**, 2001). One consequence of this imbalance is that while foreigners used to hold, even in the late eighties only between an eighth and a fifth of the US public debt, by 2000 they held more than a third of that debt (the total debt came to \$3413.2 billion).

Greenspan cannot alter these fundamentals by tinkering with the rate of interest alone. Moreover, he never tried to put a brake on the boom by asking for more margin money when shares at inflated values were used as collaterals or leveraged buy-outs. Moreover, he has been guilty of breaking his proclaimed principle of fiscal rectitude when he supported George W. Bush's plan of further indulging the rich with tax cuts even when he was escalating the war budget to unprecedented heights.

4. Mucking about with public credit in a follower country :India under the helmsmanship of the neo-liberals

India got into a payments crisis, because of the fiscal profligacy in the Rajeev Gandhi regime. The crisis was almost planned (Bagchi, 1985/2002) and certainly became a self-fulfilling prophecy after the Commerce Ministry, of which Montek Singh Ahluwalia was the secretary at the time leaked out a document which spelled out the package of reforms, including a substantial devaluation of the Indian rupee. A large proportion of exporters decided to park their earnings abroad, waiting for the devaluation and the usually unscrupulous elements sent more money overseas by using the time-hallowed *hawala* route, and the prophecy was duly realized. Among the spate of reforms which were little prepared for, the most slavish ones occurred in the fiscal and the financial system.

The majority of India's wealthy had never believed in paying their due taxes. Repeated attempts to coax them to observe better tax compliance had never succeeded. Under the regime of Rajeev Gandhi, even the nominal tax burden on the upper income groups had been further lightened. The only Finance Minister who tried to enforce the penalties against violation of tax laws was V. P. Singh, and he was soon transferred for his pains and quitted the Congress ministry soon after. With this record behind, all the three reforming Finance Ministers have outdone his predecessor in pampering the rich.

The reduction of customs duties have also taken their toll on the central budget. With other changes in government obligations and the refusal of the government to enforce better tax compliance for the rich, the combined fiscal deficit of the state and the central governments has reached new heights. With all the talk of fiscal correction

larding official pronouncements, the gross fiscal deficit of the centre and the states together as a percentage of GDP is back in the crisis year of 1990-91; it is probably running even higher now.

Another area in which the Finance Ministers have shown consistency is in their attempt to force small savers into the stock market. In no country in the world has the stock market been the main provider of funds for business. Flying in the face of that global experience (which Indian reformers seem to have been surprisingly ignorant of, from the beginning, policies were designed to revive a stock market which was never anything but a playing field of speculators, insider traders and *hawala* merchants most of the time. Unlike Mr Greenspan, the ring-masters do not have *any* success story to their credit. The Indian stock market remains as sluggish as ever, but there have been three major scams in the brief history of the neo-liberal custody of the financial affairs of this country, the Harshad Mehta-Bhupen Dalal scam, the Ketan Parekh-Kolkata brokers scam, and the government securities scam. All of them were due to specific initiatives taken by the government with almost deliberate flouting of prudential norms. I will cite only the case of the last scam starting with the Madhavpura Urban Co-operative. The urban co-operative banks were limited in the types of business they could conduct. Because of the liberal tax treatment by the government many urban traders had more money than they could profitably invest. The Reserve Bank of India allowed them to enter new businesses, licensed many more urban co-operative banks and kept them on a loose rein. They were also allowed to enter the government securities business, without going through the intermediation of the usual nationalised banks or the RBI. With the traders looking for extra earnings, and without the insistence on physical delivery of the securities, the 'gilt scam' happened. The rousing of expectations of continued kill on the stock market, and its collapse after the NASDAQ rout contributed to the fiasco.

Let us take another initiative of the government which has shown up the fiduciary irresponsibility of the government and severely damaged the interest of hundreds of thousands of small savers. This is the way the UTI, an organization which is entirely controlled by the government, has been allowed to get into the zone of illiquidity, if not bankruptcy territory through the attempt to stimulate the stock market and create a 'feel good' factor for successive Finance Ministers (Bagchi, 1999, 2002). The UTI was encouraged to invest heavily in equities, and when the stock market became depressed, it found it difficult to meet its contractual payments. This happened after small investors had been encouraged to shift their portfolios from bank deposits to UTI instruments by offering tax exemption for returns on most of the UTI instruments. To compound the evil further, in 2000, almost certainly with encouragement from the Finance ministry, the UTI authorities were encouraged to invest heavily in 2000-odd unlisted companies, although India already boasted of the second largest number of

listed companies among all the countries of the world. This boosted the morale of the backers of the coalition in power, because people in the know sold their UTI stakes when the market boomed. These lucky people included some of the largest corporate houses. But when the mini-boom collapsed the UTI announced that it could not meet most of its contractual obligations to small investors. This is obviously a gross dereliction of the fiduciary responsibility on the part of the government.

The government has gone further in its relentless drive to corral the hapless small investors into a noisy, insider trade-infested *satta-den* of the stock market India shelters. In the latest budgetary dispensation the Finance Minister banned the small investor from holding Government of India Relief Bonds beyond certain specified, small amounts. This seems to be a strange proceeding for any sovereign entity desperately trying to bridge the gap between revenue and expenditure. The game plan is not to foster a culture of equity holding but to render small investors helpless victims of big players in finance.

How does the Finance Ministry go about to further benefit a risk-averse, crony capitalism that it deliberately cultivates? One instrument is to privatize the public sector and hand it over to the big players. One of the strangest and blatantly nepotistic *diktats* of the Finance Ministry was to forbid the Indian Oil Corporation to bid for the IPCL. The latter was handed over on a platter to the Ambanis. Every time privatization of a big public enterprise takes place, the stock market looks up: people in the know can get a few more crores on the side.

Finally, the government can claim that it is after all bringing down the NPAs of the banks. But how is it doing it? The instrument is not an increase in the business of the banks, or by punishing the big defaulters whose list would be more or less coincidental with that of the much-hyped India Inc., but by allowing the effective spread between lending and borrowing rates to increase, by slashing staff strength, and by rationing out more and more small borrowers from the ambit of formal credit institutions. I calculated recently that even with the slow growth of the agricultural sector, the rate of growth of credit extended by all formal credit institutions over the decade has fallen badly short of that growth. When the banks have cleaned up their balance sheets, they will be ready for privatization and the backers of the government, including big foreign banks, will move in for the kill.

In a recent article, Biais and Perotti (2002) have shown that right-wing parties can use privatization and wide distribution of the shares as an instrument for weaning away the median-class voter from left-wing parties, because even those voters who favour redistributive policies will be afraid that reversal of investor-friendly policies will damage their own interests by bringing down share values. I don't think the Indian track record of privatization fits their model, except perhaps in Gujarat and Mumbai. Here

the basic motive driving the privatization process can be summed up by the slogan :

'Let us make hay while the Lok Sabha shines, for to-morrow we may be routed'.

Concluding remarks

The construction of a system of long-term public credit under which the state was trusted by private lenders was an innovation of the capitalist system which came to its flowering in Europe, and then spread across the globe. This system was a cornerstone of good governance : on the one hand advancing bourgeoisie were willing to help the state with loans in times of extraordinary requirements of funds; on the otherhand, the state had to keep the trust by paying the contracted service charge regularly and punctually, but it also used that trust to tax the bourgeoisie along with the common people when collective interest demanded it.

In the twentieth century, the best period of public credit, across the world was probably the era which has been often styled as the golden age of capitalism , that is, roughly from 1945 to 1971, when the Bretton Woods system of fixed exchange rates and the European welfare state were still largely intact. The systematic attempt of finance capital in alliance with the military industrial complex in the USA, UK and other western countries to wreck that system and grab an ever larger share of the world bore its fruit in the 1990s. It is again in the contradictory nature of that capitalism that precisely when triumphalism of the USA and its allies that private capital showed its worst face in the working of the large corporations and their favourite hunting ground, the stock market, and put a question mark on the reliability of the public credit of the global superpower as well (European stock markets have lost as disastrously as the New York stock exchange over 2001-2002: between May and July 2002 alone, the share price indexes of all the major stock markets in Europe and the USA have fallen by more than 25 per cent (*The Economist*, 27 July 2002, pp.61-2). Even as triumphalist accounts continue to pour forth from the USA (see, for example, Ferguson, 2001, who also supports Bush's scheme of terrorising the whole planet in the name of saving democracy), the major index of US strength has become not its economic prowess, but its status as the supreme bully-boy of the world.

It is important to understand what happened to the centre of capitalism in order to grasp what is going on in the realm of public credit and its relation to private credit in the follower country that India is. So long as there was a national project of industrialization in India, however tattered at the edges that project might have appeared by the middle of the 1980s, there was a purpose behind keeping public credit firm and the first comer in national resource mobilization projects. As that project was given up by a national leadership who had been unwilling to carry out all the major tasks needed for constructing a sustainable developmental state, it sought its embrace in the arms of global corporate and finance capital. By 1997 it was poised to go whole hog with capital

account convertibility by 2000 (following the recommendation of the Tarapore Committee set up by the Reserve Bank of India) but the breaking out of the Asian financial crisis saved it from losing whatever autonomy in policy-making it still possessed. As I have argued elsewhere (Bagchi, 2002a), full integration with world capital markets would rob any follower country of most of the autonomy of the state and make a mockery of the demand to institute a proper governance system in poor nations. In the meanwhile, a section of the ruling strata went on a spree of primitive accumulation by systematically defrauding the middle classes by creating booms and busts in the stock market, privatizing profitable public enterprises at throw-away prices, wrecking the operations of the biggest mutual fund which was controlled by the government and damaging the credibility of the government as the trustee of ultimate resort. I hope that technically well-qualified students of finance will examine the issues that I have brought up in my paper and not confine themselves to the trivialities of designing optimal contracts or optimal capital structures in a world in which the stability of expectations has been badly dented by the operation of licentious finance.

References

- Anantha-Nageswaran, V. (2002) : Maestro's composition falls on deaf ears, *The Hindu Business Line*, 22 July.
- Bagchi, A. K. (1985/2002) : Highjacking the Indian economy : Or, does political buccaneering pay? *Herald Review* (Bangalore), 5 May; reprinted with a 'Post-script' in *Occasional Papers*, Vol. X, Department of Economics, Rabindra Bharati University, 1-9.
-(1992) : Transnational banks, US power game and global impoverishment, *Economic and Political Weekly*, 27 (22), 30 May, 1133-36.
-(1999) : Globalisation, liberalisation and vulnerability: India and the Third World, *Economic and Political Weekly*, 34(45) , 3219-3230.
-(2002) : Central budget 2002-03: Creating public discredit for asset-grabbing, *Economic and Political Weekly*, 37(17), 27 April, 1585-86.
-(2002a) : Governance in East and South-east Asia: What's new? *European Journal of Development Research*, 14 (1), June, 200-218.
- Biais, B. and E. Perotti. (2002) : Machiavellian privatization, *American Economic Review*, 92(1), March, 240-258.
- Brewer, J. (1989) : *The Sinews of Power: War, money and the English state, 1688-1783*, London, Unwin Hyman.
- De Vries, J. and A. Van der Woude. (1997) : *The First Modern Economy: Success,*

failure, and perseverance of the Dutch economy, 1500-1815, Cambridge, Cambridge University Press.

Dickson, P.G.M. (1967) : *The Financial Revolution in England: a study in the development of public credit 1688-1756*, London, Macmillan.

.....and J. Sperling. (1970) : 'War finance 1689-1714', in J. S. Bromley (ed.): *The New Cambridge Modern History of Europe*, vol. VI, *The rise of Great Britain and Russia 1688-1715*, Cambridge, Cambridge University Press, pp. 284-315.

Ferguson, N. (2001) : *The Cash Nexus : Money and Power in the Modern World*, New York, Basic Books.

Harvey, C. R. and A.H. Roper.(1999) : 'The Asian bet', in A. Harwood, R. E. Litan and M. Pomerleano (eds.): *Financial Markets and Development: the crisis in emerging markets*, Washington, D.C., Brookings Institution, pp.29-116..

Miller, M., P. Weller and L. Zhang. (2002) : Moral hazard and the US stock market: analysing 'Greenspan Put', *Economic Journal*, vol. 112, March, C171-C187.

Naik, G. and S. K. Jain.(2002) : Indian agricultural commodity futures markets : a performance survey, *Economic and Political Weekly*, 37(30), 27 July: 3161-3173.

O'Brien, P. K. (1988) : The political economy of British taxation , 1660-1815, *Economic History Review*, 41(1), February, 1-32.

.....(1994) : 'Central government and the economy, 1688-1815', in R. Floud and D. McCloskey (eds.) : *The Economic History of Britain since 1700*, vol. I, 1700-1860, second edition, Cambridge, Cambridge University Press, pp. 205-247.

Shiller, R. J.(2000) : *Irrational Exuberance*, Princeton, N. J., Princeton University Press.

Van der Wee, H. (1977) : 'Monetary, credit and banking systems', in E. E. Rich and C. H. Wilson (eds.). *The Cambridge Economic History of Europe*, vol. V, *The Economic Organization of Early Modern Europe*, Cambridge, Cambridge University Press, pp. 290-392.

Woodward, B.(2001) : *Maestro: Greenspan's Fed and the American Boom*, New York, Simon & Schuster.

Rent Seeking in Hierarchical Firms

Gil S. Epstein* and Ira N. Gang**

Abstract

Hierarchical firms are enterprises with rigid internal job ladders. We examine the state enterprise as the prototypical hierarchical firm. In the state enterprise, promotion of employees through the internal hierarchy is determined by the workers' allocation of time between rent seeking and productive activity. Our model shows that given the incentive structure of the state enterprise we tend to see less productive and more adept rent seekers at senior management positions in such firms. Moreover, as we move up the firm's hierarchy, a decline in the productivity levels of the workers will be observed.

JEL Classification : D2, D72, L32.

Keywords : Inefficiency, rent seeking, hierarchical firms, promotion, internal job ladder, state enterprise.

1. Introduction

Hierarchical firms are enterprises with rigid internal job ladders. We examine the state enterprise as the prototypical hierarchical firm. In the private sector, profit maximization and the discipline it imposes is a reasonable first assumption in analyzing firm behavior. For state enterprises, public sector firms, government establishments and other similarly structured organizations the goal is more diffuse. The absence of private owners and firm accountability may result in a greater part of surpluses (rents) being found within the firm. Moreover, without clear goals it is more difficult to analyze a person's contribution to the firm, and it is more difficult to objectively determine who should be promoted and who should not be. The presence of the rents affects the incentives to seek promotion in the firm. The question we look at in this paper is whether those more adept at rent seeking have an internal advantage in seeking promotion within state enterprises. The answer is in general positive.

The firm in our model has a pyramid structure: the number of employees declines at higher levels of the internal hierarchy, and one incumbent is situated at the top-level of the hierarchy. The internal rents that are distributed within the firm increase with the level of the hierarchy at which employees are positioned. Internal rent seeking contests take place to win promotion, and thereby to secure increased rents. When less productive employees succeed in having themselves promoted, the total rents within the firm decrease, and consequently more productive workers have a decreased incentive

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to seek promotion. Less efficient senior management diminishes the incentive of the more productive employees to seek promotion, since the more productive employees have more reason to allocate time to production at their present hierarchical level within the firm. The problem confronting more productive employees is indeed whether it is worth their while participating in the internal rent seeking contests, since their comparative advantage is in productive activity rather in the types of favor-seeking activities which underlie success in the internal firm contests for promotion.

A substantial literature discusses how managers come up via competition through the ranks of the firm (see for example Beckmann (1978) and Rosen (1986)). Whereas Rosen's contests are directed at assuring efficiency, in our model efficiency is not ensured by the outcomes of the contests for promotion. This paper emphasizes how, in this same context, rents figure prominently in hierarchical firms and how comparative advantage in rent seeking influences promotion prospects.

2. The Model

Employees are risk neutral and seek to maximize expected income defined over three periods. The firm also has three hierarchical levels. Employees may seek promotion from level 3 to level 2 and then to level 1, with contests taking place once each period. Contesting promotion is personally costly in time and income foregone, since productive work is directly rewarded, not the time spent in (self) promotion activities. Workers have different comparative advantages in ingratiating themselves via rent seeking and in contributing to the value of the firm's output. An individual's income is determined by his productivity, plus the rents that accrue at different rungs of the hierarchy.

The question is: who is promoted to senior management in the state enterprise? That is, is there adverse selection in the promotion contests?

If the rewards from climbing the ladder in the hierarchy of the state enterprise are high but not high enough, less productive employees will be on higher rungs of the firm, reducing efficiency and internal rents that are available for division among the firm's employees.

Our model also considers the consequences of the internal hierarchical structure of the enterprise. We compare two types of firms, one with more rungs than the other.¹ We show that the firm with more rungs is, on average, less efficient, because at each contest level there is a higher likelihood that less productive employees (but better rent seekers) win promotion. Smaller hierarchies are, conversely, on average, more

¹ Firm structure has been analyzed in different ways, for example, the efficiency of production in different types of firm structures (Williamson (1967) and Keren and Levhari (1978, 1989)), in terms of estimating an optimal size of structure (Radner (1993)) and in terms of the probability of choosing the right type of project for a firm to concentrate on (see Sah and Stiglitz (1986)).

efficient.² However, in a firm with fewer rungs, all employees expend more time in rent seeking to facilitate promotion.

There are four employees and three time periods. Employees are divided into three groups: workers, vice-presidents and the president. In the first period all employees are on the same rung in the firm and are "workers". The workers are divided into two groups (divisions or departments within the firm), with two workers in each group. In the first period, while working in the first rung, employees can choose to compete for the position of vice-president. Those who succeed (one vice-president for each group) start in the new position in period two. The workers who lose (or did not contest) continue as workers in the second and third periods. Then, in the second period, the employees who succeeded in reaching the post of vice-president compete for the position of president. The employee who wins this competition enters the office in the third period.

The income of each employee per unit of labor is: w_i if the employee is on the first rung (i.e., a worker), v_i if the employee is on the second rung (vice-president) and p_i if the employee is the president (to simplify the notation we denote the workers in first group by the index $i = 1, 2$ and those in the second group by $i = a, b$). Income per unit of labor is an increasing function of an individual's productivity, and equals the productivity level plus the income from rent seeking.

Each individual has an endowment of labor time normalized to unity, which is allocated between productive activities A_i , and time L_i spent in rent seeking:

$$A_i + L_i = 1 \quad (1)$$

We can normalize the absolute efficiency in rent seeking to unity. w_i then defines the absolute and relative productive efficiency for one unit of time; v_i and p_i are similarly defined.

Without loss of generality, let

$$w_1 > w_2 \quad \text{and} \quad w_a > w_b \quad (2)$$

with the same type of relationship holding for v_i and p_i .

if $w_i > w_j$ then $v_i > v_j$ and $p_i > p_j$ for all $i \neq j$.

This implies that a productive employee is always more productive regardless of his position in the hierarchy.

The wage is competitively determined per efficiency-normalized unit of labor

² This latter result complements Williamson's (1967) well-known contention that low-level hierarchical organizations are more efficient. In Williamson's case this is because of greater internal goal consistency and the subsequent lesser need for expending resources on monitoring.

supplied. An employee's income is negatively related to time spent in rent seeking activities.

In order to simplify, and without loss of generality, let the discount rate be one. In period one the worker allocates time between seeking the position of vice-president and productive activity, yielding income:

$$I_i = w_i (1 - L_i) \quad (3)$$

A vice-president seeks the position of president, and has income:

$$I_i = v_i (1 - L_i) \quad (4)$$

The president does not seek a better position, and has income:

$$I_i = p_i \quad (5)$$

Let the contest-success function (Hirshleifer 1989), be determined by a non-discrimination rule (Tullock (1980), Hillman and Riley (1989)), such that i 's probability of success in competing against j is given by:

$$Prob_i(L_i, L_j) = \frac{L_i}{L_i + L_j} \quad \forall i \neq j \quad (6)$$

In order to determine an individual's optimal time allocation, we start from the second period (for an illustration see figure 1).

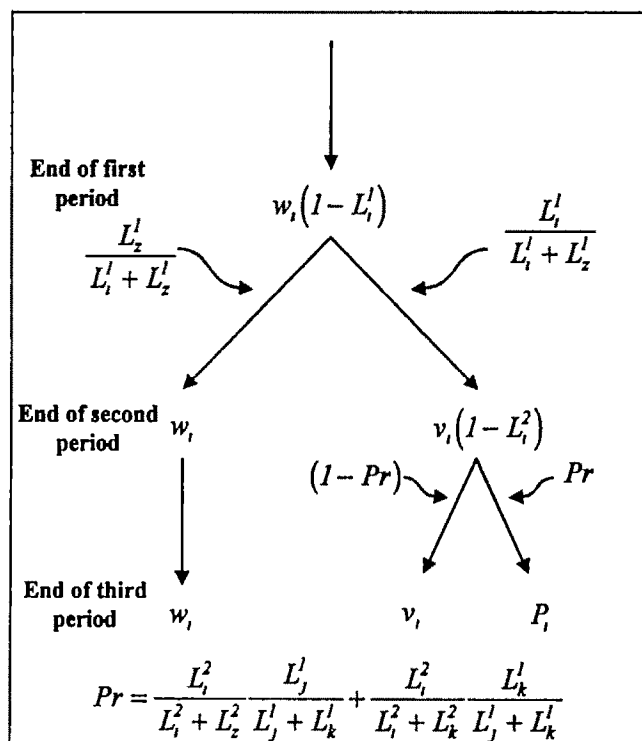


Figure 1

Second period

Let us examine individual number 1. This individual is a vice-president in the second period, and his expected income depends on whether worker *a* or worker *b* has gained the *other* position of vice-president. Worker *a* is the parallel vice-president to worker number 1, so individual 1's expected income in the second period is:

$$\begin{aligned} E(I_1^2|a) &= v_1(1 - L_1^2) + v_1 \left(1 - \frac{L_1^2}{L_1^2 + L_a^2}\right) + p_1 \frac{L_1^2}{L_1^2 + L_a^2} \\ &= v_1(2 - L_1^2) + (p_1 - v_1) \frac{L_1^2}{L_1^2 + L_a^2} \end{aligned} \quad (7)$$

L_1^2 is individual 1's rent seeking in period 2. Thus, in the third period individual 1 earns either v_1 , as vice-president, with a probability of $\frac{L_2}{L_1 + L_2} = 1 - \frac{L_1}{L_1 + L_2}$ or becomes president in period number three with a probability of $\frac{L_1}{L_1 + L_2}$, and earns p_1 .

On the other hand, the expected income of individual *a* given that individual number 1 is vice-president is:

$$E(I_a^2|1) = v_a(1 - L_a^2) + v_a \frac{L_1^2}{L_1^2 + L_a^2} + p_a \frac{L_a^2}{L_1^2 + L_a^2} \quad (8)$$

Each vice-president maximizes his expected income by choosing the extent of his rent seeking³. Expected income is determined by the Nash equilibrium rent seeking choices. For vice-president number 1:

$$\frac{\partial E(I_1^2|a)}{\partial L_1^2} = -v_1 + (p_1 - v_1) \frac{L_a^2}{(L_1^2 + L_a^2)^2} \quad (9)$$

Similarly, for vice-president *a*:

$$\frac{\partial E(I_a^2|1)}{\partial L_a^2} = -v_a + (p_a - v_a) \frac{L_1^2}{(L_1^2 + L_a^2)^2} \quad (10)$$

Setting (9) and (10) to zero and solving yields:

$$L_1^2 = \frac{(p_a - v_a)(p_1 - v_1)^2 v_a}{((p_1 - v_1)v_a + (p_a - v_a)v_1)^2} \quad (11)$$

³ The result would not change even if an individual could change the level of investment during the process of the contest when receiving new information (see Epstein 1996a, 1996b).

and

$$L_a^2 = \frac{(p_1 - v_1)(p_a - v_a)^2 v_1}{((p_1 - v_1)v_a + (p_a - v_a)v_1)^2} \quad (12)$$

We can now compute the probability of each individual reaching the position of president:

$$\text{Pr ob}_1(L_1^2, L_a^2) = \frac{L_1^2}{L_1^2 + L_a^2} = \frac{(p_1 - v_1)v_a}{(p_1 - v_1)v_a + (p_a - v_a)v_1},$$

and (13)

$$\text{Pr ob}_a(L_a^2, L_1^2) = \frac{L_a^2}{L_1^2 + L_a^2} = \frac{(p_a - v_a)v_1}{(p_1 - v_1)v_a + (p_a - v_a)v_1}$$

In order to gain a better understanding of these results, let us look at the ratio of the two employee's rent seeking activities. From equation (13) the ratio of the rent seeking values equals the ratio of the probabilities of reaching the position of president. An increase in the ratio means that the relative probability has increased.

$$\frac{L_1^2}{L_a^2} = \frac{(p_1 - v_1)v_a}{(p_a - v_a)v_1} = \frac{\text{Pr ob}_1(.)}{\text{Pr ob}_a(.)} \quad (14)$$

The question is now: who invests more in privilege seeking activities? In answer to this question, we investigate whether the ratio defined in equation (14) increases or decreases with an increase in productivity of one individual (v_1 or v_a), while holding the productivity of the other constant. We have:

$$\frac{\partial \left(\frac{L_1^2}{L_a^2} \right)}{\partial v_1} = \frac{v_a}{(p_a - v_a)} \frac{\left(\frac{\partial p_1}{\partial v_1} v_1 - p_1 \right)}{v_1^2} \quad (15)$$

which rests on the sign of:

$$\left(\frac{\partial p_1}{\partial v_1} v_1 - p_1 \right) \quad (16)$$

There are three cases we are obliged to consider:

Case 1: $p_1 = p_a$ ($p_1 = p_a > \text{Max}\{v_a, v_1\}$). Here the president's income is independent of his productivity level, and we can conclude that

Less productive employees invest more time in rent seeking activities and have a higher probability of being the president of a public firm.

This result is somewhat similar to the result presented in Epstein, Hillman and Ursprung (1999). These authors present a one period model where a contest takes place in order to win a prize. Investment, in order to affect the outcome of the contest, depends on time consumption and thus is a function of the contestants' productivity levels. The prize is fixed and equal for all contestants. These authors show that the less productive invest more time in privilege seeking activities and so have a higher probability of winning the contest.

Case 2: $p_a < p_1$, $v_a < v_1$ and $0 < \frac{\partial p_1}{\partial v_1} \frac{v_1}{p_1} < 1$. If a worker is more productive as vice-president, he will be more productive as president. Moreover, this condition also shows that, for the productive individual, the elasticity of productivity of the president in relation to an increase in productivity of that individual as a vice-president is less than one. In other words, if an individual is more productive as vice-president, he will be more productive as president. An increase in productivity of an individual as vice-president then increases the productivity of the same individual as president with a decreasing margin.

Let us look at two examples of a relationship between the productivity level of a vice-president and the productivity level of the president where the elasticity is less than one:

Example #1: $p_i = (v_i + d)^2$. For all individuals, $v_i^2 < d^2$; the more productive workers invest less in rent seeking.

Example #2: $p_i = c v_i + d v_i^{1/2}$ (d and $c > 0$); in this case, once again, more productive workers invest less in rent seeking.

In the above two examples, the productivity of the president increases with the productivity of the vice-president. The question is, what happens to the productivity of an employee who moves up a rung in the firm's hierarchy? The answer is again that:

Less productive employees invest more time in privilege seeking activities and have a higher probability of being the president of the public firm.

Case 3: $p_a < p_1$, $v_a < v_1$ and $1 < \frac{\partial p_1}{\partial v_1} \frac{v_1}{p_1}$ i.e., the elasticity of productivity

of a president with respect to a change in the productivity of the vice-president is larger than one. This case is complementary to Case 2. Here, when a worker is more productive as vice-president, his productivity increases as president by more than the increase in productivity of vice-president. An example is the complementary case of the first example in Case 2: $p_i = (v_i + d)^2$ for all individuals that it holds $v_i^2 > d^2$. Here,

More productive employees invest more time in rent seeking and have a higher probability of being the president of the public firm.

Typically in state enterprises the ratio of the compensation of a top manager and the wage of a low-level worker is small compared to the private sector. Moreover, in many cases the wage does not depend on the productivity level at all.

We now calculate the expected income level of two employees given the different possibilities of vice-presidents competing with one another. If employee 1 and employee a are vice-presidents, the expected income of individual 1 in time period 2 is given (by using equations (13) and (14)):

$$E(I_1^2|a) = v_1 \left(2 - \frac{(p_1 - v_1)^2 (p_a - v_a) v_a}{((p_a - v_a) v_1 + (p_1 - v_1) v_a)^2} \right) + \frac{(p_1 - v_1)^2 v_a}{((p_a - v_a) v_1 + (p_1 - v_1) v_a)} \quad (17)$$

Similarly,

$$E(I_a^2|1) = v_a \left(2 - \frac{(p_a - v_a)^2 (p_1 - v_1) v_1}{((p_a - v_a) v_1 + (p_1 - v_1) v_a)^2} \right) + \frac{(p_a - v_a)^2 v_1}{((p_a - v_a) v_1 + (p_1 - v_1) v_a)} \quad (18)$$

and,

$$E(I_1^2|b) = v_1 (2 - L_1^2) + (p_1 - v_1) \frac{L_1^2}{L_1^2 + L_b^2} \quad (19)$$

$$E(I_1^2|b) = v_1 \left(2 - \frac{(p_1 - v_1)^2 (p_b - v_b) v_b}{((p_b - v_b) v_1 + (p_1 - v_1) v_b)^2} \right) + \frac{(p_1 - v_1)^2 v_b}{((p_b - v_b) v_1 + (p_1 - v_1) v_b)} \quad (20)$$

We conclude, therefore, given that individual number 1 has reached the vice-

presidential post, his expected income is:

$$E(I_1^2) = \frac{L_a^1}{L_a^1 + L_b^1} E(I_1^2|a) + \frac{L_b^1}{L_a^1 + L_b^1} E(I_1^2|b) \quad (21)$$

In a similar way we calculate the values of $E(I_2^2)$, $E(I_a^2)$ and $E(I_b^2)$.

First period

In the previous subsection we solved the problem of the individual who has reached the second period and became vice-president. In this section we analyze the case of the worker during the first period who is looking forward to the second and third periods.

In time period one, individual 1's problem may be written as follows:

$$E(I_1^1) = w_1(1 - L_1^1) + \frac{L_2^1}{L_1^1 + L_2^1} 2w_1 + E(I_1^2) \frac{L_1^1}{L_1^1 + L_2^1} \quad (22)$$

namely, expected income in time period one equals the time spent working in period number 1, $w_1(1 - L_1^1)$, plus the expected value of future income. The expected value of future income from time period two is divided into two parts: first, the worker does not attain the position of vice-president and so the next two periods gets an income of w_1 . This occurs with probability $\frac{L_2^1}{L_1^1 + L_2^1} = 1 - \frac{L_1^1}{L_1^1 + L_2^1}$.

Second, the employee wins the contest and attains the position of vice-president. The probability for this happening is $\frac{L_1^1}{L_1^1 + L_2^1}$ and the expected income is as we calculated in the previous section, $E(I_1^2)$. We may rewrite worker number 1's expected income in period number 1 (equation (22)), as follows:

$$E(I_1^1) = w_1(3 - L_1^1) + [E(I_1^2) - 2w_1] \frac{L_1^1}{L_1^1 + L_2^1} \quad (23)$$

Notice that given our assumptions it holds that $E(I_1^2) - 2w_1 > 0$

In a similar way we may write the expected income of the other individuals, 2, a and b , by $E(I_2^1)$, $E(I_a^1)$ and $E(I_b^1)$, respectively.

Given the values of $E(I_2^2)$ and $E(I_1^2)$, we may calculate the optimal values of L_1^1 and L_2^1 at the Nash equilibrium. The calculations are precisely those of the previous section regarding the values of L_1^2 and L_2^2 at the Nash equilibrium given that the workers have reached the post of vice-president (in a similar way we may calculate L_a^1 and L_b^1):

$$L_1^1 = \frac{[E(I_2^2) - 2w_2][E(I_1^2) - 2w_1]^2 w_2}{([E(I_1^2) - 2w_1]w_2 + [E(I_2^2) - 2w_2]w_1)^2} \quad (24)$$

and

$$L_2^1 = \frac{[E(I_1^2) - 2w_1][E(I_2^2) - 2w_2]^2 w_1}{([E(I_2^2) - 2w_2]w_1 + [E(I_1^2) - 2w_1]w_2)^2} \quad (25)$$

Again, we can examine the ratio of the values of the levels of the privilege seeking activities of the two employees. Notice that from equation (13) the ratio of the levels of the rent seeking activities equals the ratio of the probabilities of reaching the position of president,

$$\frac{L_1^1}{L_2^1} = \frac{[E(I_1^2) - 2w_1]w_2}{[E(I_2^2) - 2w_2]w_1} \quad (26)$$

Notice that $E(I_i^2) - 2w_i > 0$ and that $E(I_i^2) > v_i$.

The results that now follow are similar to that of an employee who has a two period horizon and an objective in period one to become vice-president in period two. The employee wants, first of all, to be vice-president. If he does not attain this position he will not be able to attain the position of president. From the Tullock function, we know that it will always hold that if $E(I_i^2) > v_i$ and if $v_i > v_j$, then, $E(I_i^2) > E(I_j^2) \forall i \neq j$.

We have now:

$$\frac{\partial \left(\frac{L_1^1}{L_2^1} \right)}{\partial w_1} = \frac{w_2}{E(I_2^2) - 2w_2} \frac{\left(\frac{\partial E(I_1^2)}{\partial w_1} w_1 - E(I_1^2) \right)}{w_1^2} \quad (27)$$

Again, there are three different cases. In two of the cases (27) is negative and in one case positive. When the worker only looks one period ahead:

$$\frac{\partial \left(\frac{L_1^1}{L_2^1} \right)}{\partial w_1} = \frac{w_2}{v_2 - w_2} \frac{\left(\frac{\partial v_1}{\partial w_1} w_1 - v_1 \right)}{w_1^2} \quad (28)$$

These are not very restrictive conditions. Therefore, we conclude that,

More productive workers will invest less time in privilege seeking activities and have a smaller chance of reaching the position of vice-president and thus the position of president.

In state enterprises in which the compensation of a top manager relative to the wage of a low-level worker is relatively low or the wage on each rung is fixed and not a function of the worker's productivity level, then more productive workers have a lower probability of being on a higher rung of the firm.

3. The Structure of the Firm

In this section we consider the consequences of the structure of the state enterprise on promotion.

Increasing the number of rungs in the firm without changing the number of employees will increase the number of employees on the different rungs. If the firm contains n vice-presidents competing for the post of president, then the expected income of vice-president j will be,

$$E(I_j|n) = w_j(1 - L_j) + w_j \left(1 - \frac{L_j}{\sum_{i=1}^n L_i} \right) + p_j \frac{L_j}{\sum_{i=1}^n L_i} \quad \forall i = 1, 2, \dots, n \quad (29)$$

Thus:

$$\frac{\partial E(I_j|n)}{\partial L_j} = -w_j + (p_j - w_j) \frac{\sum_{i \neq j}^n L_i}{\left(\sum_{k=1}^n L_k \right)^2} = 0 \quad (30)$$

In order to simplify our analysis, assume that $p_i = w_i + c$.⁴ When an employee

⁴ Notice that this example fits the case of a state enterprise as stated in the previous section.

changes from vice-president to president, his income per unit of productive time increases by a constant, c . This increase in productivity is identical for all employees regardless of initial productivity. Less productive workers evidently invest more in rent seeking.⁵

Solving the n first order conditions, we obtain:

$$L_j(n) = \frac{(n-1)c \left(\sum_{i \neq j} w_i - (n-2)w_j \right)}{\left(\sum_{k=1}^n w_k \right)^2} \quad \forall i = 1, 2, \dots, n \quad (31)$$

Hence, rent seeking *decreases* as productivity increases.

We now calculate the probability that a vice-president will succeed to the post of president:

$$\text{Prob}_j(n) = \frac{L_j}{\sum_{i=1}^n L_i} = \frac{\sum_{i \neq j} w_i - (n-2)w_j}{\sum_{k=1}^n w_k} \quad (32)$$

Denote the least efficient employee by index j . If we increase the number of vice-presidents from n to $n+1$ by adding a vice-president who is more productive than employee j , then the increase in the probability will be,

$$\text{Prob}_j(n+1) - \text{Prob}_j(n) = - \frac{\sum_{i=1}^n w_i - (n-1)w_{n+1}}{n(n-1) \sum_{k=1}^n w_k \sum_{k=1}^{n+1} w_k} \quad (33)$$

If $\text{Prob}_j(n) \geq 0$ we obtain that $\text{Prob}_j(n+1) - \text{Prob}_j(n) < 0$ for all j . In other words, increasing the number of vice-presidents who are competing for the post of president decreases the probability that each of the existing vice-presidents will succeed to the post. We may conclude that:

As the number of employees competing for the same post increases, the probability of success for the least efficient employee decreases, while the probability that a more productive employee succeeds to the post increases.

⁵ The elasticity of the level of productivity of a president with respect to a change in the level of productivity of the worker is less than one.

In order to understand the results let us examine at the following two cases:

A: A three rung firm. This is the model presented above in which 4 workers are divided into 2 groups. From each group one vice-president will emerge and from the two vice-presidents one president will emerge.

B: A two rung firm of 4 workers all in one group that compete for the position of president (the firm does not have any vice-president).

Since the first case has been dealt with extensively in the previous section, we focus on the second case. Given that each worker has a productivity of w_i ($i=1,2,3,4$) each worker has an expected income of:

$$E(I_i) = w_i (1 - L_i) + w_i \left(1 - \frac{L_i}{\sum_{j=1}^4 L_j} \right) + p_i \frac{L_i}{\sum_{j=1}^4 L_j} \quad \forall i=1,2,\dots,4 \quad (34)$$

where the expected value depends upon the probability of reaching the position of president or staying in the same position on the first rung.

Thus,

$$\frac{\partial E(I_i)}{\partial L_i} = -w_i + (p_i - w_i) \frac{\sum_{j \neq i} L_j}{\left(\sum_{k=1}^4 L_k \right)^2} = 0 \quad (35)$$

As stated above we simplify matters and assume that $p_i = w_i + c$. Solving the four first order conditions, we obtain,

$$L_i = \frac{3c \left(\sum_{j \neq i} w_j - 2w_i \right)}{\left(\sum_{k=1}^4 w_k \right)^2} \quad \forall i=1,2,3,4 \quad (36)$$

The probability of a worker winning the contest and becoming the president of the state firm is,

$$\text{Prob}_i(L_1, L_2, L_3, L_4) = \frac{L_i}{\sum_{j=1}^4 L_j} = \frac{\sum_{j \neq i} w_j - 2w_i}{\sum_{j=1}^4 w_j} \quad (37)$$

Once again, more productive workers invest less in rent seeking. Moreover, as the productivity of worker k ($k \neq i$) increases, the probability of worker i 's gaining the position of president increases:

$$\frac{\partial \text{Prob}_i(.)}{\partial w_i} < 0 \text{ and for all } k \neq i \quad \frac{\partial \text{Prob}_i(.)}{\partial w_k} > 0 \quad (38)$$

Let us now compare a two rung with a three-rung firm. Assume for a two rung firm that:

$$c = 4, w_1 = 3 \text{ and } w_2 = w_3 = w_4 = 4$$

In this case:

$$L_1 = 0.32, L_2 = L_3 = L_4 = 0.16$$

and

$$\text{Prob}_1(.) = 0.4, \text{Prob}_2(.) = \text{Prob}_3(.) = \text{Prob}_4(.) = 0.2$$

Here the less productive worker is spending 32% of his time in rent seeking, while the productive workers are investing only 16% of their time in rent seeking.

For a 3-rung firm, assume:

$$w_1 = 3, w_2 = w_a = w_b = 4, p_1 = 7, p_2 = p_a = p_b = 8$$

and

$$v_i = w_i + w_i^{1/2} :$$

$$v_1 = 4.73, v_a = v_2 = v_b = 6$$

We obtain:

$$L_1^1 = 0.39, L_2^1 = 0.37, L_a^1 = L_b^1 = 0.37$$

and

$$\text{Prob}_1^1 = 0.51, \text{Prob}_2^1 = 0.49, \text{Prob}_a^1 = \text{Prob}_b^1 = 0.5$$

Given that worker number 1 is to become a vice-president, he or she will compete against either employee a or b for the position of president (notice that for our calculations it does not make a difference which of the two become vice-president, as the two are identical as far employee number 1 is concerned):

$$L_1^2 = 0.37, L_a^2 = 0.33 \text{ and } \text{Prob}_1^2 = 0.53, \text{Prob}_a^2 = 0.47.$$

Now compare the two types of firms. To simplify, call the two-rung firm I and the three-rung firm II. We see that the probability of a less productive worker becoming a president of the state enterprise is higher in firm I (0.4) than in firm II ($0.51 * 0.53 = 0.27$). Notice, however, that the probability of success for the less productive worker

at each stage in the contest is higher in firm number II than in firm number I. This worker will evidently have a greater chance of winning in firm number II than in firm I. It is clear then that in firm II there is a higher probability of a less productive worker (better rent seeker) attaining one of the higher positions in the firm (vice-president and/or president). Looking at the level of investment in rent seeking, we see that in firm I all employees invest more in rent seeking at each stage than in firm II. We conclude that:

1. The firm with the larger internal hierarchy is on average less efficient, because of the greater probability that at each level of contest less productive employees gain promotion.

2. In a lower-hierarchy firm, all employees (whether they are more or less productive) expend more time in internal rent seeking.

4. Conclusions

This paper has investigated who is promoted to senior management in hierarchical firms, as typified by the state enterprise, and whether there is adverse selection in the promotion contests. If the rewards from climbing the ladder in the firm's hierarchy are high but not high enough, less productive employees will be on higher rungs of the firm, reducing efficiency and decreasing rents available to be divided among the employees. The larger the internal hierarchy the lower the efficiency of the firm, on average, because of the greater probability that at each contest level more proficient rent seekers win promotion. On the other hand, in smaller-hierarchy firms all employees expend more time in rent seeking. We thus have a reason for the revealed inefficiency in state enterprises.

We have discussed the state enterprise as the prototype of the hierarchical firm. Our model may be generalized to a number of firms types, and will be most successful in explaining behavior in firms with a rigid hierarchical structure, in firms that possess diffuse goals, and in firms where there are potentially a large amount of rents generated. Thus the inefficiency of the public sector and the development of "sick" industries and firms are partly explained by our model. Senior management in these firms spends too much time controlling their environment. In the Soviet firm (Berliner (1957) and Granick (1954)), the Communist Party was the recruiting ground for senior management. By the time workers reached the rung in the firm's job ladder in which they had serious responsibility, they were already functioning member of the Communist Party. The inefficiency of the Soviet firm, is thus partly explained by the structure of the firm and the activities in which one needed to engage in order to win promotion.

We suggest a different explanation for the incompetency of senior management in bureaucratic organizations than is offered by the Peter Principle. The Peter Principle argues that in hierarchical organizations people are promoted in order to reward them for their (good) performance. Therefore, they are promoted until they reach their "level

of incompetence" in the firm, and are stuck in that level, since another bureaucratic rule is that people never get demoted. Our argument is not that the good people are being "over-promoted", but that, for the most part, the good people are always "overlooked" for promotion. Those people who are not especially good at producing spend their time in promotion seeking activities (which are not productive). It is these people who earn the promotions. If these people are generally incompetent (a bad worker makes a bad manager), this is bad for the firm, raising its inefficiency.

References

- Beckmann, M. J. (1978) : *Rank in Organizations*, Berlin: Springer-Verlag.
- Berliner, Joseph S. (1957) : *Factory and Manager in the USSR*, Harvard University Press, Cambridge.
- Epstein, G. S. (1996a) : Changing a Decision Taken Under Incomplete Information During the Process of Execution, *Journal of Economic Behavior and Organization*, Vl. 29, 323-329.
- Epstein, G. S. (1996b) : The Extraction of a Natural Resource from Two Sites Under Uncertainty, *Economics Letters*, Vl. 51 (3), 309-313.
- Epstein, G. S. Hillman A. L. and Ursprung H. W. (1999) : The King Never Emigrates, *Review of Development Economics*, 1999, 3(2), 107-121.
- Granick, David (1954) : *Management of the Industrial Firm in the USSR*, Columbia University Press, New York.
- Hillman, A.L. and Riley, J.G. (1989) : Politically Contestable Rents and Transfers, *Economics and Politics*, 1, 17-39.
- Hirshleifer, J. (1989) : Conflict and Rent Seeking Success functions: Ratio Vs Difference Model of Relative Success, *Public Choice*, 101-112.
- Keren, M. and Levhari, D. (1989) : Decentralization, Aggregation, Control Loss and Costs in Hierarchical Model of the Firm, *Journal of Economic Behavior and Organization*, 213-236.
- Keren, M. and Levhari, D. (1979) : The Optimum Span of Control in Pure Hierarchy, *Management Science*, 1162-1172.
- Radner, R. (1993) : Hierarchy: The Economics of Managing, *Journal of Economic Literature*, 1382-1415.
- Rosen S. (1986) : Prizes and incentives in Elimination Tournaments, *The American Economic Review*, 76(4), 701-715.

- Sah, K. R. and Stiglitz, J. E. (1986) : The Architecture of Economic Systems: Hierarchies and Polyarchies, *American Economic Review*, 716-723.
- Tullock, G. (1980) : Efficient Rent Seeking In J.M. Buchanan, R.D. Tollison, and G. Tullock, editors, *Toward a Theory of the Rent Seeking Society* (Texas A&T Press, College Station TX).
- Williamson, O.E. (1967) : Hierarchical Control and Optimum Firm Size, *Journal of Political Economy*, 75, 123-138.

GLOBALISATION, INTERNATIONAL TRADE AND WELFARE*

Pasquale M. Sgro*

Abstract

The term globalization is generally used to describe an increase in international transactions in markets for goods and services and factors of production, plus the growth and expanded scope of many institutions that straddle international borders. Globalization has also led to a more liberal economic environment where issues such as labour standards, human rights, the environment, intellectual property rights, investment codes and competition policy are now considered legitimate topics in the trade debate. Free global markets cannot guarantee that air, water or energy resources are accurately priced for sustainable development since there is no mechanism to internalize environmental costs. Economic growth, although a powerful tool for increasing a country's wealth, cannot guarantee that such wealth will be equally distributed. What is needed is environmental and social policy to redistribute the benefits.

Recent empirical studies show that there are clear signs of income convergence among countries that integrate more fully with the world economy but a divergence between these active participants and those who elect to remain insulated from global markets. The inequality within nations (distribution of income) has increased during the period of globalization over the last fifty years.

JEL Classification : F02 and F10

Keywords : globalisation, regionalism, income inequality

1. Introduction

Globalization is predominately an economic process but through its impact on culture, government and virtually all aspects of domestic policy-making, it has a powerful social effect. The term "globalization" also generally means an increase in international transactions in markets for goods, services and factors of production, plus the growth and expanded scope of many institutions that straddle international borders. These institutions include firms, governments, international institutions and non-governmental organizations (NGO). It also includes foreign direct investment (FDI), multinational corporations (MNCs) and integration of the world capital flows. Globalization historically has been driven by forces unrelated to policy. These forces include: productivity improvements, rising potential gains from specialization, and the transport revolution, each of which may have different implications for the distribution of world income compared to policy changes such as liberalizing trade.

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The impact of globalization has transformed the world into a number of different regions with different characteristics:

- North-America, Western Europe and Japan which are highly developed.
- The Asian 'tiger economies' of Hong Kong, Thailand, Malaysia, Korea, Singapore and Taiwan are reaching the status of highly industrialized countries (even with the Asian crisis of 1997).
- The rest of Asia including China and India which still have backward economies and low income levels and provide labor services for the faster-growing economies.
- Latin America with its spending growth, economic dependence and political conflict.
- Africa, largely excluded from the global economy, with declining income, appalling social conditions, conflicts and refugee flows.
- The 'transition' economies (the former Soviet bloc) with restructuring of economies and institutions pushing them towards market economies.

Globalization has also led to a more liberal economic environment where issues such as labor standards, human rights, the environment, intellectual property rights, investment codes and competition policy are now considered legitimate topics in the trade debate.

The labor standards debate concerns the extent to which low wages and poor working conditions in developing countries constitutes an unfair advantage to them (relative to the developed countries) or merely reflect the inherent advantage of "surplus labor" economies. The environment debate concerns the different values placed on the environment by different countries and the extent of the benefits/costs that accrue to countries or regions most affected by such activities. Pricing these environmental costs to reflect the true economic costs to society is a technical issue. Just as important, however, is the institutional structure required to design, collect and implement the appropriate policies, such as a global carbon tax, while dispute resolution is seen as an important issue in this area. Arguments have also been put that the trade instrument is a potentially powerful sanction mechanism to enforce desirable changes in environmental policies. However, one has to be ever vigilant that this environmental concern is not used as a convenient device to disguise protectionism. Intellectual property rights involve the practicalities of knowledge creation, control and ownership. For example, the appropriate valuation and treatment of indigenous knowledge is particularly relevant for developing economies.

Another aspect of this increased trade or globalization is the expectation that

growth and development based on global market forces would be more sustainable and more widely shared than in the past. In some cases this expectation has not been realized and there is still a substantial gap between developed and developing countries. What is required is sound domestic policies supported by an enabling global environment and economic cooperation at the international level. In order to share the benefits of globalization, international organizations may have to intervene rather than relying purely on market forces. For example, free global markets cannot guarantee that air, water or energy resources are accurately priced for sustainable development since there is no mechanism to internalize environmental costs. Economic growth, although a powerful tool for increasing a country's wealth, cannot guarantee that such wealth will be equally distributed. What is needed is environmental and social policy to redistribute the benefits.

Globalization has also led to an increase in international capital flows. This increase has been particularly evident in bank and other private firm lending to emerging market economies both in the form of direct and portfolio investment. The mechanism of the direct investment is to create both employment opportunities as well as demand for capital, plant and equipment. This demand for capital equipment facilitates the transfer of technology and encourages higher growth rates.

Freer international trade in both goods and services is also accelerating the integration of the world economy as well as increasing national competition and cooperation. This increased integration is evident at the microeconomic levels as firms expand across national borders through equity investment or through non-equity linkages that integrate independent firms. At the macroeconomic level, international economic integration is increasing as barriers to trade are reduced through regional trade agreements, GATT and the WTO.

2. Foreign Direct Investment and Multinational Enterprises

Foreign Direct Investment (FDI) generally consists of: 1) new equity capital such as a new plant or joint venture; 2) reinvested corporate earnings and 3) net borrowing through the parent company or affiliates and under ownership and control of a business or part of a business in another country. Portfolio investment, on the other hand, involves the purchase of securities in a domestic firm solely to earn a financial return rather than ownership and/or control. There has been phenomenal growth in FDI and in the past decade its growth has been twice that of fixed capital investment, indicating an increasing internationalization of production systems. As well, over the last twenty years, there has been a shift in the pattern of foreign direct investment (FDI) by multinational enterprises (MNEs). There are three reasons why these shifts have occurred. First, changes in the competitiveness of the MNEs; second, changes in what these

Table 1
The Distribution of Foreign Direct Investment Inflows by Host Region and
Country 1975-80 and 1990-96
(US\$ millions)

	1975-80		1990-96		Index of FDI growth 1975-80 = 100
	Annual Average	%	Annual Average	%	
Total inflows	32 183	100.0	234 724	100.0	729.3
<i>Developed Economies</i>	24 642	76.6	153 381	65.3	622.4
Western Europe	13 874	43.1	92 295	39.3	665.2
of which: European Union ^a	13 190	41.0	83 947	35.8	636.4
North America	8 757	27.2	50 942	21.7	581.7
of which: US	7 895	24.5	44 757	19.1	566.9
Japan	152	0.5	1 013	0.4	666.7
<i>Other Developed Economies</i>	1 859	5.7	9 169	3.9	493.2
of which: Australia	1 271	3.9	5 805	2.5	456.7
<i>Developing Economies</i>	7 539	23.4	74 778	31.9	991.9
Africa	810	2.5	3 498	1.5	431.9
Latin America & Caribbean	4 014	12.5	22 536	9.6	561.4
of which: South America	2 377	7.4	12 824	5.5	539.5
Asia	2 489	7.7	48 075	20.5	931.5
of which:					
South, East and S.E. Asia	1 971	6.1	45 857	19.5	2326.6
West & Central Asia ^b	518	1.6	2 217	0.9	428.1
<i>Other Developing Economies^c</i>	226	0.7	668	0.3	295.8
Central and Eastern Europe	3	Neg.	6 565	2.8	218 847.6

Notes:

^a Includes the 12 member countries of the European Union in 1994

^b Including the Middle Eastern countries

^c The Pacific and developing Europe

Neg. = negligible

Sources: UNCTC, Transnational Corporations and World Development (New York, UN 1988); UNCTAD, World Investment Report 1995: Geneva and New York: United Nation 1998).

Table 2
The Largest Recipients of Inward FDI 1975 – 1980 and 1990-1996
 (annual averages)

Developed Countries					
Country	1975/80 \$m	% ^b	Country	1990/96 \$m	%
USA	7 894.0	32.0	USA	44 757.1	29.2
UK	5 795.4	21.1	UK	19 613.4	12.8
France	2 127.3	8.6	France	19 080.1	12.4
Netherlands	1 276.6	5.2	Belgium	10 012.1	6.5
Australia	1 271.4	5.2	Spain	8 579.3	35.6
Belgium ^d	1 203.1	4.9	Netherlands	7 770.9	5.1
Germany	1 052.6	4.3	Canada	6 185.3	4.0
Spain	970.5	3.9	Australia	6 118.9	4.0
Top 8	20 991.6	85.2	Top 8	12 2117.1	79.6
All	4 642.0	100.0	All	153 380.9	100.0
Developing Countries ^a					
Country	1975/80 \$m	% ^c	Country	1990/96 \$m	% ^c
Brazil	1 835.8	24.4	China	22 424.7	30.0
Mexico	1 023.5	13.5	Singapore	7 081.7	9.5
Malaysia	524.3	7.0	Mexico	5 622.1	7.5
Singapore	502.0	36.7	Malaysia	34 289.0	35.7
Egypt	376.1	5.0	Argentina	3 690.3	34.9
Iran	315.5	4.2	Brazil	3 222.7	4.3
Indonesia	289.9	3.8	Indonesia	2 842.6	3.8
Hong Kong	241.1	3.2	Thailand	2 179.9	2.9
Top 8	5 108.2	67.8	Top 8	51 353.0	68.7
All	7 539.1	100.0	All	74 777.6	100.0

Notes:

^a Bermuda was, in fact, ranked higher – sixth, but we have excluded the tax haven from our rankings

^b Of all developed country investment

^c Of all developing country investment

^d And Luxembourg

Sources: UNCTC, Transnational Corporations and World Development (New York, UN 1988); UNCTAD, World Investment Report 1995: Transnational Corporations and Competitiveness (New York and Geneva, UN 1995); UNCTAD, World Investment Report 1998 (Geneva and New York: United Nations 1998).

MNEs seek from the countries in which they invest, and third, a transformation in the way production and the local markets are linked. Table 1 below (Dunning (2000)) sets out the changing distribution of the flows of FDI by region and country of destination between two periods (1975 - 80) and (1990 - 96). An inspection of the table will show that there have been quite significant shifts over the last 20 years. The South, East and South East Asia and Central and Eastern Europe have increased their share of investment while Japan and the European Union (EU) have had smaller gains.

Table 2, also from Dunning (2000), provides the details divided into developed and developing economies. On balance, there has been a slight trend towards a more even geographical distribution of FDI over this period, with the MNEs responding to globalization by integrating their sourcing, value-added and marketing activities and treating the world as a whole as a source for their resources.

In the years 1975-1980, the ten largest recipients of FDI identified in the above table accounted for 74.1% of all FDI inflows, and in 1990 - 1994 they accounted for 68.8%. In the former period, Japan accounted for only 0.6% of all inflows into developing countries, and in the latter for 1.0%.

The expansion in FDI for developing economies has caused some problems when the country's financial sector has been underdeveloped or non-existent. The Asian Crisis of 1997 was partly caused by such a view of the financial sector (as well as a perception of corruption). Debate has taken place over the manner in which FDI is directed to better benefit the economic development of the host country.

There is convincing historical evidence that short-term capital movements contribute to volatility in financial markets, which in turn leads to macroeconomic instability. This is further aggravated when the exchange rate is fixed or pegged because it provides short-term lenders and borrowers with a guarantee against adverse exchange rate movements. On the other hand, if the exchange rate is flexible, then it adjusts with the inflow and outflow of capital so that international lenders have to factor in the exchange rate risk into their calculations and may moderate excessive short-term capital movements.

In addition to capital movements, the health and stability of the banking and financial sectors are important in determining the country's vulnerability to a currency crisis. The financial sector played an important role in the Asian crisis of 1997/98 since the crisis was more liquidity driven rather than the usual solvency driven events. The issue of contagion also played a role whereby several countries with important trade links to the country that first experienced the crisis were similarly effected by a common shock. Thus both trade linkages and financial interdependence contributed to the transmission of the crisis via spillover effects. Nevertheless, despite these problems, the growth potential for the Asian developing economies is quite high. This is due partly to 1) high

domestic savings rates, 2) improving literacy levels or human capital resources and 3) catch-up and market development.

Historically, the shortage of human capital such as skilled labor and managerial talent has been a crucial reason in limiting foreign investor interest and hence restricting the growth rates in developing economies. When FDI has occurred, it has been a source of foreign exchange and tax revenue in addition to its modernizing of industry role. Also the standard of living has generally increased in these economies although there are still issues of equity and the distribution of the income.

In the four decades from 1945 – 85, global economic expansion was taking place mainly within and among the OECD countries. In the aftermath of the 1980s debt crisis, a large number of developing countries began to liberalize their economies, dismantling trade barriers as well as domestic production subsidies. Their trade expanded both with OECD countries but also with other developing countries. In the 1990s the former soviet bloc countries had emerged seeking new markets and trade partners resulting in an unprecedented degree of expansion in FDI with a fourfold increase between 1985 – 95. This large FDI flows have been facilitated by governments privatizing state-owned enterprises.

From a development perspective, FDI should help in the transfer of technology and know-how from developed to developing countries. This transfer would thus hasten economic development as well as the integration of such economies into the world markets. Unfortunately there is no guarantee that this inflow of investment will perform this role. For example, there is still regional imbalances in development despite the free mobility of capital (and usually labor) in the region. Governments have responded by trying to direct investment to certain industries or regions by providing incentives in the form of tax-breaks and other subsidies and in turn requiring specific export performances to aid development and growth.

The environmental impact of FDI depends on two factors. First, the system of managing the environment and second the transfer of environmentally sound technology. In practice, environmental damage tends to be greatest in low-productivity operations working with obsolete technology, outdated work methods, poor human resource development and inefficient capital and energy use. MNEs can be seen as a repository of clean technologies, which can be transferred to developing economies. Alternatively, they can be seen as relocating pollution production and inferior technologies to their subsidiaries in developing economies, thus exploiting the technology gap and adding to overall pollution.

The role of foreign banks complement the MNE presence in both developing and developed economies. Foreign bank participation has a number of points in its favor. These include increasing the amount of funds available for domestic projects by facili-

tating capital inflow and improving the quality of financial services and system infrastructure such as accounting, transparency and financial documentation. A counter view is that foreign banks decrease financial stability by facilitating capital flight or enabling capital to move more quickly out of a country in a crisis. What is clear is that like MNEs, the presence of foreign banks is increasing as part of the globalization process.

There have been some attempts at the international level at setting out the best practices for prudential supervision of banks, particularly in emerging markets. The Basle Committee on Banking Supervision (BCBS) set out some core principles in 1997 that should be applied to have an effective supervisory system. These principles relate to:

- preconditions for effective banking supervision
- licensing and structure
- prudential regulations and methods of banking supervision
- information requirements
- formal powers of supervision
- cross-border banking principles

and are minimum requirements which should be supplemented by other measures as appropriate (Das (2000)).

These concerns have also led to a proposal for the setting up of a World Financial Authority (WFA) to provide and supervise financial regulations although it is not clear why such an organization would be more successful than the IMF in achieving stability.

3. Regionalism and Trade

Regionalism in world trade has also both positive and negative implications for liberalization and for multilateralism. On the negative side, regionalism may perpetuate an unequal form of liberalization as outsiders are excluded. For example, countries bordering the European Union (EU) have problems trading with the EU because some of the trade partners, although sanctioned by GATT/WTO rules, are protectionist and restrictive. Regional trade institutions may also be used by states as an alternative to multilateral institutions. Thus RTAs yield incomplete liberalization; neither fully protectionist nor fully open.

On the positive side, the new regionalism is being driven more by markets and less by policies or by fiat or even enlightened bureaucrats. This regionalism is more a product of the expansion of trade and cross-border investments among neighboring countries after unilateral liberalization. In fact, regionalism or RTAs can be seen as serving

as a transition point between relatively closed economies and a genuinely global economic system. Geographical proximity and transborder externalities provide favorable factors for regionalism and growth.

Globalization implies an extensive growth of the world market that will dominate the national economies. This implies a dominance of the world market over structures of local production as well as an increasing prevalence of "Western-type consumerism". The New Regionalism can also be seen as an attempt to assert some degree of territorial control and cultural diversity as a response to these global trends. Globalization also implies the growth in freer trade and this growth, whether it has come about through regional or multilateral agreements, has benefits for both developed and developing countries. The benefits include the following: (1) static gains from trade – enables each country to concentrate its production on those goods that it has a comparative advantage in; (2) consumers save by being able to purchase goods at a cheaper price; (3) higher wages and more stable employment; (4) gains in total factor productivity and (5) catch-up benefits whereby poorer countries are able to catch up with their richer trading partners by increasing their incomes.

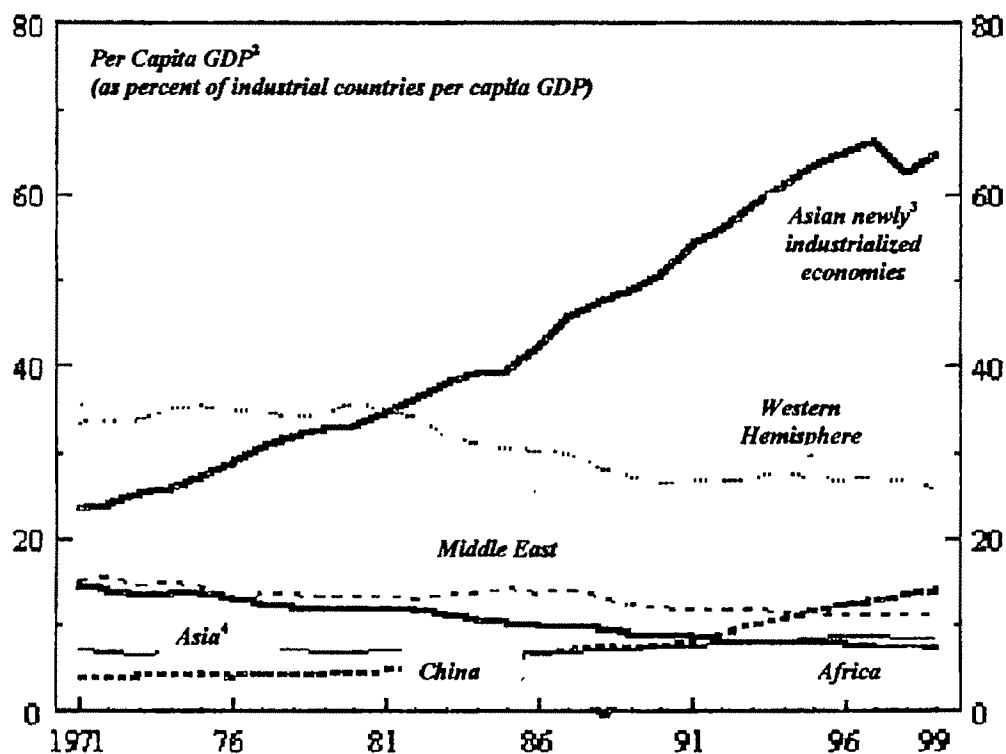
4. Globalization, Development and Institutions

One way in which governments have sought to manage and regulate problems arising from transnational activities is through international organizations (IOs). There has been a steady increase in the number of IOs to over 250 at the end of the 1990s. There has also been an increasing number of treaties, regimes and other cooperating arrangements among states. Alongside IOs, there has also been a growth in non-governmental organizations (NGOs) and these numbered over 500 at the end of the 1990s. These NGOs play a transnational role and have been active in some specific international negotiations on such issues as the environment.

Given the role of globalized financial markets, the role of international financial institutions like the International Monetary Fund (IMF), the World Bank (WB) and the International Bank for Reconstruction and Development (prior to World Bank) became even more important as a way of ensuring stable exchange rates and equitable growth. Eichengreen (1999) provides some useful suggestions on how the IMF should behave in the new international environment. He suggests that in addition to the IMF role of providing financial assistance to countries in need, it will also need to establish international standards on the operation of financial markets; monitor the compliance to these standards and informing the market. Its lending should be conditional on this compliance.

In addition, the IMF will need to become active as a facilitator or coordinator of restructuring negotiations, create and provide incentives for the setting up of a standing committee of creditors. The most difficult role will be to reach a consensus on what

Figure 1a
Developing Countries Newly Industrialized Asian Economics¹



Source : IMF, *World Economic Outlook*, May 2000: Direction of Trade

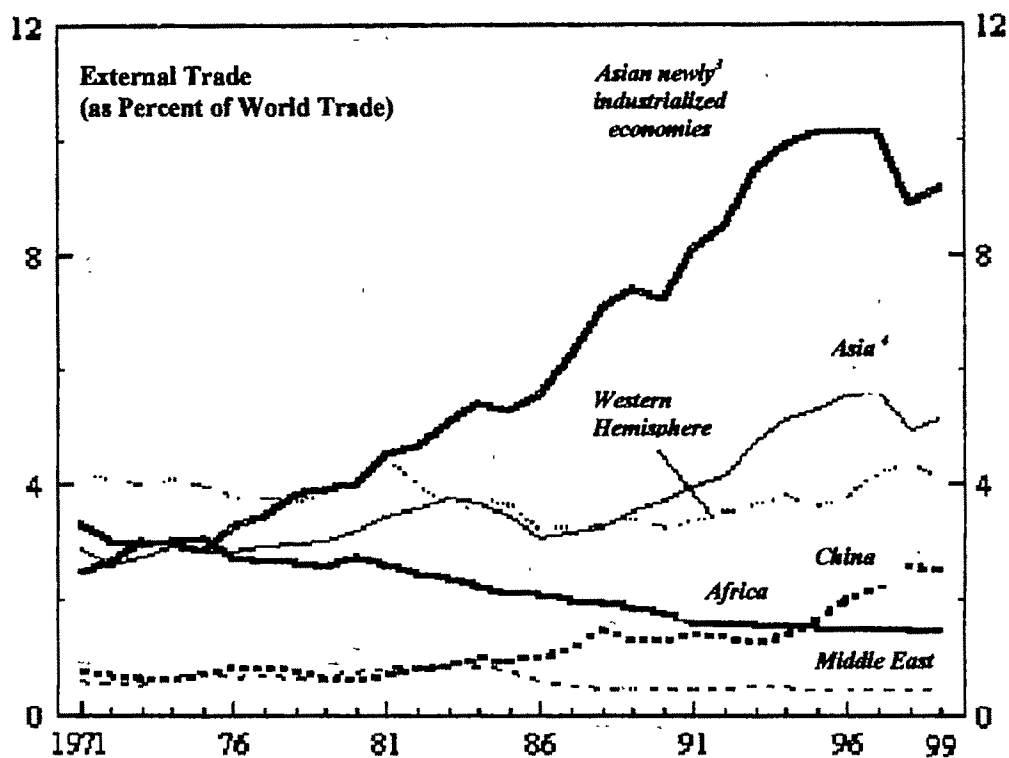
1 Excludes oil exporting countries

2 Purchasing power parity terms

3 Hong Kong SAR, Korea, Singapore, Taiwan Province of China

4 Excludes China

Figure 1b
External Trade



Source : IMF, *World Economic Outlook*, May 2000: Direction of Trade

1 Excludes oil exporting countries

2 Purchasing power parity terms

3 Hong Kong SAR, Korea, Singapore, Taiwan Province of China

4 Excludes China

kind of macroeconomic and financial policies to recommend to its developing country markets, given the realities of today's liquid but unreliable capital markets. Other institutions that play a role in providing stability in the international financial markets include the Bank of International Settlements (BIS), the Group of Ten (G-10) and the Group of Seven (G-7). Despite all these institutions, the Asian financial crisis of 1997 and the Mexico peso problem in 1994 has led governments to re-examine the role of international regulations and institutions.

It is commonly said that globalization implies that world trade and financial markets are becoming more integrated. This integration was to lead to growth and catch-up in developing economies. However, the experience in developing economies has been mixed. On the international trade front, developing economies have increased their share of world trade from 19 per cent in 1971 to 29 per cent in 1999. However it can be seen from Figure 1 that there is a great deal of variation with the newly industrialized economies (NIEs) of Asia doing well while Africa has not done so well.

Does globalization restrict the national governments in their policy making? The IMF view is that on the contrary, globalization assists governments in making good economic policies. Others argue that national policy makers continue to ignore the social environmental and institutional reforms necessary to bring about an increase in living standards.

Developing countries' support for the WTO is equivocal because they feel that their trade and development opportunities with developing economies is restricted. The WTO could move towards addressing the legitimate aspirations of developing countries by: opening developed economic markets more to developing countries' exports; supporting capacity building measures and technical assistance in trade policy and dispute settlement on a much larger scale; early and substantial initiatives in debt-reduction for reforming low income nations, and in being aware of tariff and non-tariff barrier pressures in sensitive sectors such as textiles and agriculture. In other words, the WTO must demonstrate the capacity to reflect and respond to broad societal priorities of the developing countries by acknowledging the interdependence of these broad issues with the international trade regime.

5. Trade, Environment and Economic Growth

The United Nations Conference on the Environment and Development (UNCED) linked environmental policy with development and emphasized that for effective environmental policies, it is necessary to first address poverty and income inequality issues. In addition, developed countries must reduce their energy intensity of economic growth. Japan has partially succeeded whereas in the United States it continues to increase. The pollution intensity of economic growth in developed countries is influenced by :

- a) restructuring in the economy, leading to a higher share of less resources intensive sectors, such as services in total gross domestic product
- b) increased eco-efficiency leading to a reduction in resources consumed
- c) environmental awareness altering consumption patterns.

These same factors, however, may lead to increased pollution in the developing economies as growth is pursued. Many developing countries are following the traditional path of industrialization, which is based on resource-intensive technology. Industrial countries had lower environmental standards at earlier stages of their development and it has been argued that developing countries should be compensated for their contributions rather than being threatened by trade sanctions if they do not comply. Furthermore, the technology used in developing countries is not necessarily the most advanced eco-efficient technology and consumption and environmental awareness is lacking due to poverty and rapid population growth. In general, irrespective of the development level of a country, technology is the most important factor in reducing the environmental impact of economic growth. Access to technology and the need to provide the basic human needs in developing economies is an important issue. This requires open markets for products as well as a suitable international financial mechanism to facilitate access to these environmentally sound technologies.

The influence of globalization and trade liberalization on sustainable development can be both positive and negative. Trade and environmental policies can in fact complement each other, however, care needs to be taken that environmental protection is not just trade protection in another guise and that trade rules do not conflict with appropriate environmental protection rules. A relevant consideration is that since the economy wide and sectoral effects of trade liberalization are difficult to identify and quantify, the relationship between these effects and the related environmental benefits is even more complex. In fact, the environmental benefits of removing trade restrictions are likely to be indirect and difficult to identify. In a well-functioning market based economy, if market prices fail to capture the effects of environmentally-damaging activities, there will be a misallocation of resource use (including environmental resources) and a sub-optimal outcome. One of the important developments that has occurred recently is the shift from environmental impact assessments of trade policies to sustainable impact assessments which weigh up the costs and benefits in economic terms. This is an attempt to integrate economic, environmental and social development concerns.

There have been widespread concerns about the natural resource use and environmental damage caused by the emphasis on trade and economic development. At the same time, trade policy discussions, including those in the WTO, have concentrated on the trade effects of environmental policies. The ongoing debate on trade and environmental policy distinguishes between domestic environmental problems where coun-

tries, it is argued, should be allowed to set their own standards. This does imply that low-income countries are free to choose lower air and water quality standards to develop a comparative advantage in pollution-intensive industries. The remedy in this case, however, is to correct the market failure and establish property rights rather than international trade policy, the argument being that environmental resources are not properly priced in the markets and since consumers do not bear the true cost of environmental resources, they tend to over-exploit. Where production and consumption decisions of one country impose environmental externalities on other countries (international environmental externalities), there is a stronger case for international trade policy intervention, although the more efficient solution would be to identify the source of the problem and take steps to internalize the environmental costs by getting the polluter to pay. Examples of this latter type of problem include global warming and biodiversity destruction which require multilateral cooperation such as a tax on carbon emissions. To protect endangered species, for example, there already exists the convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) which prohibits the trade in ivory, tiger skins and other products culled from endangered species. It requires that trade be subject to authorization by government-issued permits or certificates and was signed in 1975 by more than 125 countries. This restriction is based on certain types of trade and is to foster sustainable development but may conflict with international trade law (the WTO).

There exist large differences across countries in environmental policies just as there are vast differences in other policies such as human rights, worker rights, education and health. In addition to the differences between countries in endowments of natural resources and environment, there are also differences in tastes and preferences for such endowments. As globalization increases, pressure to reduce trade barriers also increase. Part of this pressure reflects the concerns in countries with high environmental standards that higher production costs are making them less competitive compared with countries with lower standards. These differences are further highlighted as other traditional barriers to trade diminish. At the multilateral level, cooperative inter-governmental mechanisms for environmental policy have only recently been formed and will take time to become effective, while distorted world markets and a failure to apply economic instruments which support sustainable development is also a factor. The first-best remedy is to remove these market distortions which damage the environment and restrain development as well as devising mechanisms to internalize the environmental costs. An argument to justify applying trade restrictions is the case when environmental damage is directly and conclusively caused by trade. There have been a series of international agreements, with different groups of countries as signatories, tackling some of this more obvious environmental degradation that has occurred.

Due to the activities of the Canadian environmentalists in the early 1980s, and the

US and European environmentalists during the NAFTA debates in the early 1990s, the WTO set up the Committee on Trade and Environment (CTE) in Marrakesh in 1994. The mandate of this committee was to consider trade and environment's interrelationships and was directed to report to the first biennial meeting of the WTO which took place in Singapore in December 1996. The main issues discussed by the CTE were threefold. First, the relationship between trade and the various multilateral environmental agreements (MEAs) such as the Basle Convention and the Montreal protocol. The Basle convention on the Controls of Trans-boundary Movements of Hazardous Wastes and their Disposal, adopted in 1989, seeks to regulate the import and export of hazardous wastes to ensure that they are managed in an environmentally sound manner. The Montreal protocol on substances that deplete the ozone layer prohibits trade with parties that trade in ozone depleting substances and products harmful to the ozone layer. Second, the use of eco-labeling to convey information on harvesting processes with the product. Third, the relationship between market access and environmental measures. This last issue was of special interest to developing economies who were concerned that environmental laws would be used to limit their access to northern markets in the form of "green protectionism".

In addition to CITES and the Montreal and Basle Conventions, other International Environmental Agreements include the Convention on Biological Diversity (CBD), the Framework Convention on Climate Change (FCCC) and the Kyoto Protocol and the North American Agreement on Environmental Cooperation (NAAEC).

World Environmental Organization

One of the more promising trade developments that has come to the fore is a discussion on a new world agency on the environment, aimed at improving environmental quality through bargained deals on the environment. Such a World Environmental Organization (WEO) would focus on removing impediments to bargaining (and trades) on the global environment. Whalley and Zissimos (2000) argue that the present global environment regime fails the objective for internalizing global environmental externalities and raising global environmental quality. There are essentially three reasons why this internalization has not occurred. First, it is difficult for negotiations to occur between groups who have an interest in the management practices used for environmental resources. Governments, for example, may not have direct control of the resources under negotiation. Second, the free-rider problem is ever present where, since the benefits of environmental protection abroad are a public good, these individuals may not be willing to contribute. This free rider problem also applies to governments. Third, enforcement of contracts is difficult due to the time inconsistency problem. For example, if agreements are reached to meet environmental targets, the payment for such concessions may take place immediately (and then more requested in the future) or

postponed until the end of the agreement with no guarantee of being paid.

Since many global environmental issues have the character that one group of countries has custody over several groups of assets, negotiations will not proceed without cash transfers. These cash transfers will be in the non-environmental areas so that no particular rules or obligations are necessary. The objectives of the WEO would be that those who have custody of assets should, through bargaining, be able to persuade those who do not and who place a high value on these assets, to pay for higher standards of environmental management. This process would also facilitate cross-country concessions to be exchanged between environmental and non-environmental areas. For example, developing countries might trade concessions on their environmental management in return for improved trade access.

The WTO involves bargained concessions on trade barrier reduction but no cash is exchanged and only national governments may bargain. The WEO allows cash for commitments and bargains are not restricted to national governments. The WEO could also provide support to domestic groups attempting to improve compliance with domestic environmental claims. None of the existing international environmental institutions are issue or project based while the WEO's aim is the internalization of environmental costs. Their work, therefore, would be complementary to such organizations as the Commission on Sustainable Development (CSD), the United Nations Environment Program (UNEP), the Global Environment Facility (GEF) and of course the WTO. This being the case, such a global environmental regime based on mechanism design rather than principles could become a reality sooner rather than later if the global environmental quality continues to worsen.

6. Trade, Investment and Competition

In a world where trade and investment liberalization is growing, competition policy becomes very important. This is especially so if, at the same time, the countries are going through a process of privatization and domestic deregulation of previously public sector companies and utilities. For example, if the necessary regulatory structure is not set in place, the replacement of a public monopoly by a private company can create a new monopoly (the telecommunications industry in most countries is a good example of this).

These risks are greater for developing countries due to the emergence or persistence of anti-competition practices of foreign or private national companies. Add to this an underdeveloped financial infrastructure, small markets and no national competition laws, then one can see that the risks of not benefiting from the liberalization are quite high. The issue of competition has been addressed by the WTO ever since the Uruguay Road negotiations. There have been Agreements on Anti-Dumping (AAD); on Safeguards and Subsidies; Trade-related Investment Measures (TRIM); Trade-related

Aspects of Intellectual Property Rights (TRIPS); General Agreement on Trade in Services (GATS), basic telecommunication services, technical barriers to trade (TBT), sanitary and phytosanitary (SPS). There have also been attempts at encouraging competition at the international level through multilateral agreements. For example, the agreement on TBT tries to ensure that regulatory standards and testing do not create an unnecessary barrier to trade. That is, whatever standards are used, to protect the health of humans, animals or plants, they are fair and equitable.

Trade is not necessarily liberalized by the absence of competition rules but precisely by their active enforcement. Trade may not be enhanced much by harmonizing competition rules but by making sure that active competitive policies are established in all countries that participate in the world trading system. The types of policies referred to under competition rules can be fairly broad and include all policies that affect competition or contestability (potential competition) in a market or more narrowly defined, those set of laws and policies adopted by a country to remedy private or public restrictive business practices such as abuse of dominant market position, monopolization, price discrimination and the like.

The link between competition policies and trade liberalization is based on the notion that competition rules may help eliminate private barriers to trade by making the domestic industries more competitive and hence more efficient. However, even with competition rules in place, enforcement of these rules is the issue. There may be compliance costs but the costs of non-enforcement are larger.

Other points of view have been put forward that argue that competition is a domestic policy issue and as such should be dealt with by national governments or alternatively that a multilateral agreement on "minimum" competition standards should be negotiated. In the case of cross-border issues, these could be dealt with under bilateral cooperation agreements. The proposal for a multilateral agreement on competition policy is very contentious. There are issues of harmonization of national policies, extraterritoriality, contingent protection issues (such as anti-dumping) and domination of small domestic markets which will need to be resolved. The main advantages of such an agreement would be that it would consolidate several existing multilateral trade agreement, it would be transparent and there would be an agreed dispute resolution system set up as part of the agreement.

On the issue of trade and investment, there had been some earlier discussions within the OECD on the multilateral agreement on investment (MAI). Some earlier agreements in this area include bilateral investment treaties (BITs) of which there were 1,513 treaties signed by the end of 1997, and the TRIMs, which focused on narrowly defined trade related investment measures. The measures that were identified in the TRIMS agreement and that had to be removed, were those in violation of

GATT Articles III (National Treatment) and XI (Quantitative Restriction). These measures included local content rules and tying the exports to quantity of imports.

The discussions on the MAI within the OECD were discontinued in late 1998 due to disagreements on including labor and environmental standards, cultural exceptions and regional integration agreements. The OECD members were reluctant to expand their commitments to liberalize foreign investment beyond what already existed in WTO and free trade arrangements.

The aim of investment for developing economies is to help them integrate into world markets through the transfer of technology and know-how, and improve their manufacturing and export performance. However, these same countries face the policy dilemma of how to combine market access and national treatment with policies that promote more liberal FDI policies and international competitiveness. That is, for their development, they may wish to encourage particular industrial structure and target specific industries whilst at the same time, to benefit from investment, they need to open up their economies and let the markets decide where investment will end up.

A combination of investment incentives and performance agreements are often used to pursue specific development objectives including directing resource allocation to specific sectors where the country perceives a growth potential. It is also the case that FDI projects have not always led to an increase in the host country's growth and/or welfare.

7. Trade, Income Inequality and Poverty

There are many definitions of the phenomenon of poverty. One commonly used definition is to define a poverty line and then use statistical definitions to arrive at the exact number of people below this poverty line. This definition of the poverty line varies from country to country and does not necessarily capture the "depth of poverty". Furthermore, this poverty line is not static in that families move into and out of poverty. Generally we can explore the effects of trade and trade policy on poverty via four broad groups of institutions as set out in Figure 2.

If we ignore intergenerational issues for the moment, then we can think of a household unit where the welfare of the unit depends on income and prices they face for purchasing goods and services. Clearly, the institutions of enterprises, distribution channels and government all impinge on the households. If we concentrate on the trade policy influences, it is obvious that there will be effects of world price changes, via trade policies, through the transmission channels to households. There may also be direct effects if the households are themselves directly importing or exporting. The results of fields research in 1999 and 2000 (Oxfam – IDS (1999) and Summers (2000)) emphasizes the critical role of markets in determining the poverty impacts of trade and other liberalization. Where conditions for the poor have improved, then there has been

Table 3 : Post-1980 Globalizers : Per Capita GDP growth, Openness, and Tariffs (Defined by increases in trade volumes)

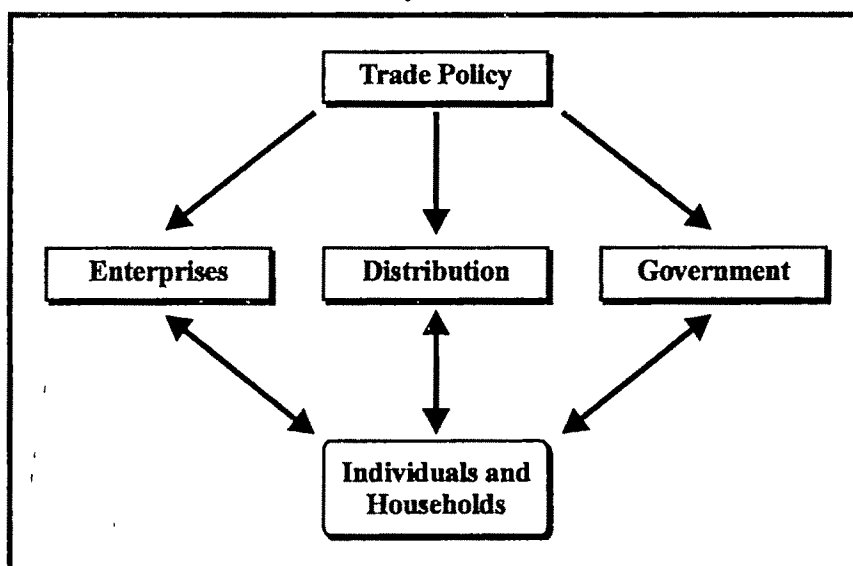
Country	AVERAGE GROWTH RATE					AVERAGE OPENNESS					AVERAGE TARIFF RATE				
	1970's	1975's	1980's	1985's	1990's	1995's	1970's	1975's	1980's	1985's	1990's	1995's	1985's	1990's	1995's
ARGENTINA	2.3%	1.0%	-3.2%	-2.0%	6.8%	5.2%	0.11	0.13	0.16	0.16	0.24	0.33	27.5	13.9	11.0
BANGLADESH	-7.0%	3.2%	1.2%	3.1%	3.4%	3.7%	0.10	0.12	0.14	0.14	0.19	0.27	92.7	54.3	26.0
BRAZIL	8.8%	3.8%	-2.9%	1.5%	0.9%	1.6%	0.11	0.11	0.10	0.10	0.14	0.18	45.8	21.0	11.5
CHINA	1.4%	3.4%	3.9%	1.7%	8.6%	7.8%	0.13	0.14	0.27	0.29	0.30	0.34	38.8	39.9	20.9
COLOMBIA	4.0%	3.5%	0.0%	2.5%	2.4%	0.6%	0.34	0.31	0.33	0.33	0.45	0.59	29.4	16.6	12.2
COSTA RICA	3.4%	3.6%	-3.6%	2.0%	2.0%	-0.1%	0.74	0.77	0.71	0.82	1.08	1.28	19.5	12.6	11.2
DOMINICAN REP	7.6%	1.7%	-2.1%	3.5%	1.8%	5.6%	0.39	0.32	0.41	0.40	0.56	0.92	..	17.8	16.2
HAITI	1.4%	3.4%	-3.4%	-2.2%	-7.3%	-0.3%	0.32	0.43	0.48	0.51	0.67	0.99	11.6	..	10.0
HUNGARY	5.9%	2.8%	1.2%	1.4%	-2.8%	3.3%	0.41	0.47	0.48	0.53	0.58	0.74	18.0	9.9	14.8
INDIA	-1.2%	0.7%	3.3%	4.1%	2.6%	4.4%	0.13	0.14	0.16	0.16	0.17	0.22	99.4	61.9	38.3
IVORY COAST	1.6%	5.1%	-3.8%	-3.6%	-3.4%	3.3%	0.54	0.53	0.70	0.67	0.68	0.76	26.3	23.8	20.7
JAMAICA	2.5%	-3.8%	-0.1%	3.4%	-0.8%	-2.7%	0.80	0.76	0.77	1.07	1.09	1.26	18.4	19.6	10.9
JORDON	8.2%	10.8%	1.1%	-4.3%	1.4%	-1.6%	..	0.94	1.18	1.04	1.62	1.66	16.3	15.8	16.0
MALAYSIA	6.5%	6.6%	3.8%	3.0%	5.8%	5.4%	0.89	0.92	1.07	1.21	1.74	-2.20	14.9	14.3	8.9
MALI	0.8%	4.5%	-1.3%	1.1%	-1.8%	2.3%	0.29	0.30	0.43	0.51	0.52	0.51	18.8
MEXICO	4.5%	3.3%	-2.3%	-0.2%	2.4%	4.2%	0.17	0.18	0.21	0.23	0.33	0.50	16.7	12.8	12.8
NEPAL	0.7%	11.0%	1.0%	2.0%	3.0%	2.2%	0.16	0.25	0.31	0.32	0.42	0.60	21.8	16.1	11.0
NICARAGUA	2.7%	-9.8%	0.5%	-7.5%	-2.2%	..	0.49	0.53	0.66	0.51	0.68	0.85	22.1	12.7	10.7
PARAGUAY	3.7%	5.2%	-4.2%	-0.7%	1.0%	-0.2%	0.28	0.32	0.32	0.38	0.77	0.99	10.9	13.1	9.3
PHILIPPINES	3.1%	3.3%	-3.1%	2.9%	-0.6%	3.1%	0.40	0.42	0.52	0.56	0.75	1.06	27.8	24.5	17.2
RWANDA	-0.9%	2.8%	0.4%	-1.5%	-14.9%	3.0%	0.19	0.23	0.56	0.30	0.47	0.37	33.0	38.4	..
THAILAND	1.8%	6.2%	3.0%	6.9%	6.0%	1.5%	0.47	0.47	0.50	0.59	0.85	0.95	41.0	36.6	23.1
URUGUAY	0.1%	2.8%	-6.3%	4.1%	4.9%	4.3%	0.35	0.43	0.47	0.50	0.66	0.84	33.7	18.9	9.6
ZIMBABWE	5.8%	-3.1%	0.0%	-0.9%	0.4%	3.1%	..	0.44	0.44	0.45	0.59	0.77	9.2	17.2	21.5
AVERAGE	2.8%	3.0%	-0.7%	0.8%	0.8%	2.5%	0.4	0.4	0.5	0.5	0.6	0.8	30.7	23.3	15.8
POP WGT AVG	0.9%	2.6%	2.5%	2.5%	5.0%	5.4%	0.2	0.2	0.2	0.3	0.3	0.4	59.4	43.7	25.5

Note : Growth is annual average growth rate of per capita GDP is constant prices (World Bank); openness is exports and imports in constant prices relative to GDP in constant prices (World Bank); tariff is the import-volume-weighted average of tariff lines (UNCTAD) Data are for five-year averages, except for the period labeled "1995a" which is the three year period 1995-1997. Data are averages over the period, except for "tariff", which is the beginning of period figure. [Source : Dollar and Krasy (2000)]

better performance or access to markets. Where they have deteriorated, the blame seems to rest with faulty or missing markets. Economic growth, unless it worsens the distribution of income, is very important in alleviating poverty in the longer run. If the openness of trade or trade liberalization enhances growth, then trade would have beneficial effects on poverty. The debate on trade liberalization and growth is ongoing with some agreement that in the short-term there may be a one-off improvement in efficiency but in the long-run the effect is not clear. What is clear however, is that if markets are not operating efficiently or are faulty or missing altogether, then it is difficult to reap the benefits and avoid the costs of liberalization. Policies therefore have to be in place to ensure that markets develop and continue to function through the process of trade liberalization. The type of policies that are appropriate include (1) infrastructure support, (2) creation of market institutions to achieve economies of scale and reduce transaction costs (3) development of credit markets to provide credit to domestic firms and countries and (4) facilitate the setting up of new businesses through freeing up regulations. These policies should be put in place before or at the same time that trade liberalization takes place.

Figure 2

The Analytical Scheme



Source : Winters (1999)

Empirical work on the effects of trade liberalization on poverty has been carried out recently by Dollar and Kraay (2001). Their study concentrates on countries that have recently liberalized trade during the period from the 1960s to the 1990s. They select eighteen countries using the criteria of a large decline in tariffs (as a measure of trade liberalization) and the increase of their trade to GDP "post 1980". There is a

Table 4
Summary of Globalization's Effects on World Inequality

Epoch	Global Inequality Trend	Inequality between nations Effects of Globalization	Inequality within nations Effects of Globalization
1500-1820	Rising inequality	Rising inequality No clear net effect.	Rising inequality (W. Europe) No clear net effect.
1820 - 1914	Rising inequality	Rising inequality Participants gain on non-participating countries. Among Participants, migration reduced inequality more than capital flows raised it. Freer trade may have reduced inequality with exceptions	No clear trend Globalization raised inequality in the New World, reduced it in participating Old World nations.
1914-1950	No clear inequality trend	Rising inequality Retreat from globalization widened the gaps between nations	Falling inequality (in OECD) No clear net effect
1950-2000	Slightly rising inequality	Slightly rising inequality Globalized trade and migration narrowed the gaps among participants. Non-participants fell further behind.	Slightly rising inequality (in OECD) Globalization raised inequality within OECD countries. In other countries, non-participating regions fell behind.
Overall 1820-2000	Rising inequality	Rising inequality Globalized trade and migration narrowed the gaps among participants. Non-participants fell further behind.	No clear trend No clear net effect.

Source: Lindert P.H. and J.G. Williamson "Does Globalization Make the World More Unequal" paper presented at the NBER Globalization in Historical Perspective Conference in Santa Barbara, California May 3-6, 2001, page 53, Table 5.

certain ad hoc nature to their selection but their results are informative. The results of the study are presented in Table 3. In Table 3, the average per capita GDP growth rate is used to represent changes in national income, while openness is represented by average exports plus imports relative to GDP. An indication of trade liberalization is represented by the trade-weighted average tariff rate reduction for five year periods, starting with 1960 – 64 and ending with 1995 – 1999. Since the tariff data is not particularly reliable prior to 1985, the earlier years' data are not presented.

A number of points are clear from Table 3:

- Trade to GDP varies enormously across countries – this is not surprising as there are numerous exogenous factors such as population, location etc. that play a role.
- There have been wide-ranging economic reforms in trade and other areas. Thus it is not clear if the effects noted are solely due to trade reforms.
- The per capita growth rates have accelerated for all of the globalizing economies between the early 1980s and the late 1990s.
- Only in the 1990s do a significant part of the developing world grow at a faster rate than the rich countries. There has been a trend towards growing equality among open economies with developing economies such as China, India, Mexico and Vietnam growing at rates far above those of the OECD countries.

An examination of the income distribution within open poorer countries seems to show a reduction in poverty. Those poor countries not involved in trade are falling further and further behind. A general conclusion that emerges from the study is that absolute poverty in the globalizing developing economies has fallen sharply in the past 20 years and that open trade regions lead to further growth and poverty reduction in small countries. Table 4 provides a summary of the empirical results from another recent survey on the effects of globalization on World Income Inequality by Lindert and Williamson (2001). Their study concludes that globalized trade (and migration) narrowed the inequality gaps between participating nations with the non-participants following further behind. The income inequality within nations, certainly in the last 50 years, has increased in both participating and non-participating economies.

8. International Labor Standards

The issue of labor standards and international trade policy, although not new as an issue, has acquired new importance as part of the multilateral trade negotiations including the NAFTA discussions. In the NAFTA case, the argument was that labor standards were not enforced in Mexico at a sufficiently high level so that competition under NAFTA would place the US domestic industries at a disadvantage vis-à-vis their Mexican competitors.

The general principles of labor standards can be summarized as follows (Brown et al 1997):

- 1) freedom of association
- 2) the right to organize and bargain collectively
- 3) freedom from forced labor
- 4) a minimum age for employees
- 5) acceptable conditions of work including a minimum wage, limitations on hours of work, and occupational safety and health rights in the workplace.

The concern of the world economy about labor standards has been the weak enforcement of labor standards, especially in developing countries. The basic economic argument is that countries that do not guarantee and enforce these rights domestically have an undue cost advantage in their export trade since the private costs do not fully reflect the social costs (that would include those standards). Of course, there are ethical concerns to do with basic human rights that are also relevant.

By using the labor standards as an issue, it may be that the motive is a purely protectionist one. It may also be possible that forcing developing economies to adopt cost-saving labor standards may be harmful to their economic interests and counter their efforts to reduce protectionism and open up their economies to freer trade. There is also the neo-institutionalists' view that the imposition of labor standards may have positive welfare and growth effects via raising the income level of workers through capital-labor substitution, workers training and more harmonious workplaces.

9. Harmonization

The case for the harmonization of labor standards and free trade depends very much on the market setting. Unlike the case of harmonization on a zero tariff through GATT which is extremely robust, when carried over to labor (or environmental standards) the welfare results is not clear cut. In so far as there is a market failure in the labor market, then its elimination is clear. However, the type of market failure will not be uniform across all countries and in fact one could expect diversity in working conditions as a norm. This does not mean however that if labor standards are designed for income redistribution reasons such as slave or child labor, that they are appropriate since the efficient solutions in this case are highly inequitable.

The issue of child labour is an important and ongoing problem. What is clear is that the extent to which employers violate ILO codes and labour standards regarding fair labour contracts, they are exploiting both adults and children. What is also clear is that the exploitation of Third World children is at the expense of their schooling, which is their best investment in the long run. What is required therefore is, first, international

and national monitoring to enforce legal codes and second, pressure to be exerted on governments to supply tax-based schooling

A view that has gained considerable support within the ILO and the WTO is that the comparative advantage that developing countries derive from their lower wages and levels of social protection are legitimate as long as they serve to encourage development and are not maintained artificially as a commercial strategy. In fact, most of the 135 members of the WTO are also members of the ILO. Coupled with this view is the intention that each country translates its economic development resulting from trade liberalization into genuine social progress and the introduction of a voluntary global system of "social labeling" to guarantee that internationally traded goods are produced under humane conditions.

10. Conclusion

The recent developments in world international trade have become more important due to the increased volume of international trade or globalization as it is more popularly designated. The growth in foreign direct investment and multinational enterprises has been an important feature of this growth although the effects of freer mobility in international capital markets has had serious unintended consequences such as its impact on the Asian Crisis in 1997. This capital mobility has forced a certain discipline on the domestic and other policies (including the foreign exchange rate regime) of some of the developing economies although this discipline may not be conducive to rapid growth and development. In addition, developing economy policies are subject to pressure from major industrial powers and multilateral institutions while part of the cost of membership of international organizations like the OECD or NAFTA is that a number of discretionary policy instruments are no longer available.

Globalization has had an impact on the environment and international labor standards. International institutions such as the International Monetary Fund, the World Bank and the WTO are well aware of these issues and attempts have been made (although perhaps not overly successful) to reduce environmental damage and improve labor standards. A proposal for a World Environmental Organization has been a welcome input into the debate. Concerning the future of labor standards, the consensus among the international institutions like the WTO and ILO is that labor standards should not be used for protectionist purposes, nor should they compromise the comparative advantage of countries. Pressure should be brought to bear on national governments to adopt policies to gain tax support for schools and thereby also increase their human capital resources in the long run.

References

- Akyüz, Yilmaz, and A. Cornford (1999) : Capital Flows to developing countries and the reform of the international financial system, *UNCTAD Discussion Paper* No.

143, November 1999.

BCBS (Basle Committee on Bank Supervision) (1997) : Core Principles for Effective Banking Supervision, *Basle, Bank of International Settlements*.

Brown, D.R., A.V.Deardorff and R.N.Stern (1997) : International Labor Standards and Trade: A Theoretical Analysis, in *Bhagwati, J.N. and R.E. Hudec (eds) Fair Trade and Harmonization*, Cambridge, MIT Press, p227-280.

Das, D.K. (2000) : Asian Crisis: Distilling Critical Lessons, *UNCTAD Working Paper* No. 152, December 2000

Dollar, D. and A. Kraay (2001) : Trade, Growth and Poverty, *Development Research Group*, World Bank. January. 2001.

Dunning, J.H. (2000) : The New Geography of Foreign Direct Investment in N. Woods (ed) *The Political Economy of Globalization*, London, McMillan Press, 20-53.

Eichengreen, B. (1999) : *Towards a new International Financial Architecture: A Practical Post-Asia Agenda*. Washington Institute for International Economics.

IMF (2000) : Globalization: Threat or Opportunity?, p1-5.
[<http://www.imf.org/external/np/exr/ib/2000/041200.htm>]

Lindert, P.H. and J.G. Williamson (2001) : Does Globalization Make the World More Unequal, *NBER Globalization in Historical Perspective Conference*, Santa Barbara, California, May 3-6, 2001.

Oxfam – IDS (1999) : Liberalization and Poverty. *Final Report DfID*, Argas

Spencer, B.J. (1992) : What Should Trade Policy Target? Ch 4, in P. Krugman (ed), *Strategic Trade Policy and the New International Economies*, Cambridge, Mass., MIT Press, p69-89

Tussie, D. and N. Woods (2000) : Trade Regionalism and the Threat of Multilateralism in N. Woods (ed) *The Political Economy of Globalization*, London, McMillan Press, p54-76.

Whalley, John and B. Zissimos (2000) : A World Environmental Organization? Working Paper 63/00 (November). CSGR, the University of Warwick.
[<http://www.warwick.ac.uk/fac/SOC/CSGR/wpapers/wp6300.pdf>.]

Winters, L. Alan (1999) : Trade, Income Disparity and Poverty. *Special Studies 5*, WTO, Chap. 3, p43-69.

Winters, L. Alan (2000a) : Trade Liberalization and Poverty. *Discussion Paper No. 7*, *Poverty Research Unit*, University of Sussex, UK.

PROTECTION WITH FOREIGN-OWNED CAPITAL IN A MONOPOLISTICALLY COMPETITIVE MODEL

Partha Sen*

Abstract

I set up a model of a small open economy with a monopolistically competitive sector, where all the capital is foreign owned. I show that a tariff on the imported brands lowers welfare if capital is not mobile but increases welfare if capital is mobile.

JEL Classification : F0, F2, F4.

Keywords : tariffs, monopolistic competition, capital inflows.

1. Introduction

The major surge in decolonisation in the 1950's and the 1960's saw the colonial powers relinquishing political power in the colonies but in most cases the economic stranglehold that they had on their former colonies remained undiminished. In particular, the ownership of capital remained pretty much totally with the former colonial powers. In the newly independent states, however, there was a desire to protect and stimulate domestic industry and hence a clamour for protection. Much has been written about the desirability or otherwise of import substitution versus outward-looking strategies. A more specialised question is addressed in this paper, namely "Was this a wise strategy to have been followed given that capital employed in that country was foreign-owned and therefore, (at least some of) the benefit of protection could accrue to foreigners?"

In the trade and development literature, a variant of the above question has been discussed at length. This is the literature associated with the Brecher-Diaz-Alejandro proposition. This looks at an economy where a tariff is already in place and looks at the consequences of an increased inflow of foreign capital. It concludes that such an inflow could be immiserizing for the recipient country. Growth with repatriation of capital's income is welfare-reducing in the presence of a distortion.

In a perfectly competitive world, a tariff is welfare reducing for a small open economy—i.e., an economy which is unable to affect its terms of trade—in the absence of other distortions. In other words, the optimal tariff for a small economy is zero. In models of "new theories" of international trade, in the presence of monopolistic

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competition (see e.g., Krugman (1979), Ethier (1982)), however, the optimal tariff becomes positive (see Venables (1982) and Helpman and Krugman (1989)). Trade restrictions increase the size of the domestic differentiated goods sector which was "too small" from a social point of view, thereby increasing welfare.¹ In a monopolistically competitive set-up but with no tariffs, Sen, Ghosh and Barman (1997) show that the Brecher-Diaz-Alejandro proposition is unlikely to hold under reasonable assumptions—an increase in the amount of foreign capital increases the capital intensive differentiated good thereby raising the welfare of the representative individual.

In this paper, I want to examine the interaction between foreign-owned capital, commercial policy and welfare in an imperfectly competitive set-up. In particular, I want to examine the effect on welfare of the small open economy with a monopolistically competitive sector, of an increase in the tariff rate on imports (starting from zero) when the foreign owned capital is either immobile or mobile. I show that a tariff is welfare-improving when foreign-owned capital is mobile but welfare-reducing when the capital is immobile. Hence in the case where capital is immobile, protection to the sector where price is above marginal cost does not increase welfare. Since I do this in a two-factor version of Venables (1987) model, this points to the fact that the result of a welfare-improving tariff depends on the effects on factor incomes (in addition to its effect on prices), which are unaffected in a one-factor model.

The results obtained are quite intuitive. A tariff raises the return to capital and lowers the return to labour—it is the capital-intensive sector, which is being protected—and raises the output per firm. Through the latter channel prices of domestic brands rise thus lowering welfare (although entry takes place which could put downward pressure on prices). When capital is mobile, on the other hand, the tariff only causes entry and thereby raises welfare—factor prices, prices and quantities of individual brands are constant across equilibria.

This analysis also has some implications for the debate on the sequencing of current versus the capital account in the process of external liberalisation of an economy. Suppose the economy under consideration wished to liberalize its foreign transactions. Should the current account be liberalized before the capital account? Much has been written on this subject. The analysis of this paper suggests that a GATT-WTO-type reduction in tariff could be harmful for an economy that is confronted with mobile capital and has mostly foreign capital employed in domestic production. Therefore, the analysis in this paper gives qualified support to liberalizing the current account before opening up the

¹ Monopolistic competition has been used widely in economics recently. See Matsuyama (1989) for applications of a monopolistic competitive framework to analyze problems in macroeconomics, development, location etc.

capital account.²

The rest of the paper is organized as follows: in section 2, I set out the model. In section 3, I look at the effects of a tariff under the assumption that the foreign-owned capital is immobile. The case of mobile capital is analysed in section 4, and some concluding observations are offered in section 5.

2. The Model

We consider a small open economy, which takes all foreign variables as given. The domestic residents consume a homogeneous product and a differentiated good. The economy produces the homogeneous good and of the differentiated good n brands are produced locally (n is endogenous) and n^* are imported (the domestic economy cannot affect n^*). The excess of domestic production over domestic consumption of the homogeneous good is exported. The domestic brands of the differentiated good are non-traded. This assumption is common in the small open economy setting (see e.g., Venables (1982), and Sen, Ghosh and Barman (1997)).

Consumers

The (upper-tier) utility function of a representative consumer is assumed to be Cobb-Douglas

$$U = X^\alpha y^{1-\alpha} \quad (1)$$

This is maximized subject to the budget constraint

$$Z = P \cdot X + y \quad (2)$$

The maximization exercise gives rise to the following demand functions

$$X = \alpha \cdot Z / P \quad (3)$$

$$\text{and } y = (1-\alpha) \cdot Z \quad (4)$$

For later we will use the indirect utility function

$$V = q \cdot P^{-\alpha} \cdot Z \quad (5)$$

where α is the share of differentiated good in consumption, y is the consumption of the homogeneous good (the numeraire), P is the price index associated with the quantity index for the differentiated good X , q is a constant and Z is income. P and X are defined in equation (6) and (7) below. Assuming the number of consumers to be one, Z becomes the national income.

The price index is defined by

² It can only be a qualified support because the model abstracts from financial flows, current account imbalances etc. In addition, whether the foreign capital is a stock or a flow (e.g., an intermediate input) is also open to interpretation.

$$P = \left[\sum_{i=1}^n p_i^{1-\sigma} + \sum_{j=1}^{n^*} p_j^{*1-\sigma} \right]^{\frac{1}{1-\sigma}} \quad (6)$$

where $p_i, (p_j^*)$ is the price of a domestic (foreign) brand and σ is the elasticity of substitution between brands. The quantity index for the differentiated goods X is defined by

$$X = \left[\sum_{i=1}^n x_i^{\frac{\sigma-1}{\sigma}} + \sum_{j=1}^{n^*} x_j^{*\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (7)$$

Demand for the domestic and foreign brands of the differentiated good are given by

$$x_i = p_i^{-\sigma} P^{\sigma} X \quad i = 1, \dots, n \quad (8)$$

$$x_j^* = p_j^{*- \sigma} P^{\sigma} X \quad j = 1, \dots, n^* \quad (9)$$

Below we shall assume that each producer is small in relation to the market and takes P and X as given and hence σ becomes the elasticity of demand facing a producer.

We shall be looking at symmetric equilibria, where all domestic (resp. foreign) firms are identical and therefore in what follows we shall drop the subscript i (resp. j) for p, x and n (resp p^*, x^* and n^*).

Firms

The homogeneous good is produced under competitive conditions with a constant returns to scale technology using two inputs, labour and capital. The price (unity for the numeraire) equal to marginal (and average) cost equation for this good is given in equation (10)

$$a_{Ly} \cdot W + a_{Ky} \cdot r = 1 \quad (10)$$

where W is the wage rate and r is the rental rate on capital. The a_y 's are functions of the factor prices (this is also true of the coefficients in equations (11) and (12) below).

The differentiated good is produced under conditions of increasing returns to scale. The market structure for this good is monopolistically competitive. There are a large number of potential varieties available for production of which n brands are produced domestically.

The variable cost component in the differentiated goods sector uses a linear homogeneous technology employing labour and capital

$$a_{Lx} \cdot W + a_{Kx} \cdot r = m \quad (11)$$

where m is the marginal cost of producing a unit of output(x) in a representative firm.

Each firm has to employ some labour and capital as overhead. The fixed cost of production is given by

$$a_{LF} \cdot W + a_{KF} \cdot r = F \quad (12)$$

where an input with an “F” subscript denote its use as an overhead and F is the “fixed” cost. I assume that substitution between inputs used in fixed cost component may be possible and the level of fixed costs change—these are inputs which have to be in place before production can begin—see Atkinson and Stiglitz (1980) (section 7.3 especially equations 7.30a and 7.30b) for a similar model.

Firms active in the differentiated goods market maximize profits. This implies that in equilibrium the price of a domestically produced brand is a mark-up ($\sigma/(\sigma-1)$) on marginal cost (we are now using σ as the elasticity of demand).

$$(\sigma/(\sigma-1))(a_{Lx} \cdot W + a_{Kx} \cdot r) = p \quad (13)$$

In addition we assume that free entry drives profits down to zero in the domestic differentiated goods industry — the Chamberlinian “large group” case. Hence, in equilibrium, for each firm the fixed cost, F , represents a proportion ($1/\sigma$) of total revenue ($p \cdot x$) (equation (14) below), the rest, a proportion $(\sigma-1)/\sigma$ of revenue, goes to cover the variable cost (equation (13) above).

$$(a_{LF} \cdot W + a_{KF} \cdot r) = p \cdot x / \sigma \quad (14)$$

Market Clearing

The market-clearing equation for labour is given below

$$a_{Ly} \cdot Y + a_{Lx} \cdot nx + a_{LF} \cdot n = \bar{L} \quad (15)$$

where \bar{L} is the supply of labour, Y is the output of the homogeneous good and nx is the domestic production of the differentiated good.

We assume that all capital is foreign-owned. Two possibilities are considered in this paper: (a) capital is immobile and (b) capital is mobile. These two polar cases imply that the capital market clears either when (16) holds or when (17) holds (\bar{K} is the fixed amount of capital)

$$a_{Ky} \cdot Y + a_{Kx} \cdot nx + a_{KF} \cdot n = \bar{K} \quad (16)$$

$$r = \bar{r} \quad (17)$$

The market for domestically produced brands of the differentiated good i.e., the non-traded goods market must clear

$$x = p^{-\sigma} \cdot p^{\sigma-1} \cdot \alpha Z \quad (18)$$

The Government

The government levies a tariff at a rate t^* on the imported varieties and rebates the tariff revenue $t^*n^*p^*x^*$ in a lump sum manner to domestic residents.

In a model such as ours there are two factors of production and three “lines of production” namely the homogeneous good, the variable cost component and the fixed cost component of the differentiated good. The relative factor intensities will play a crucial role in the analysis below. Also given that the number of factors is less than the “lines of production”, factor intensities in value terms —i.e., shares in cost (the θ_{ij} ’s below) will differ from the physical intensities —i.e., shares of an input used in a “line of production” (the δ_{ij} ’s below).

This completes the specification of the model. We now turn to the effects of a tariff—first with immobile capital and then with mobile capital.

3. A tariff on the imported brands with immobile capital

Starting from a position of free trade, the domestic government levies a tariff of t per cent on all the imported brands of the differentiated good. How does this affect the domestic economy and, in particular, what happens to the welfare of the representative individual. We shall see that with immobile capital, protection expands the size of the domestic monopolistically competitive sector but reduces welfare.

Logarithmically differentiating equations, (10), (13) and (14) we have (a “hat” over a variable denotes a percentage change e.g., $\hat{x} = dx/x$)

$$\theta_{Ly} \cdot \hat{W} + \theta_{Ky} \cdot \hat{r} = 0 \quad (19)$$

$$\theta_{Lx} \cdot \hat{W} + \theta_{Kx} \cdot \hat{r} = \hat{p} \quad (20)$$

$$\theta_{Lx} \cdot \hat{W} + \theta_{Kx} \cdot \hat{r} = \hat{p} + \hat{x} \quad (21)$$

where θ_{ij} is the share of the i^{th} input in the j^{th} cost equation.

We can solve the above three equations for \hat{W} , \hat{r} and \hat{p} in terms of \hat{x} . These are given in equations (22), (23) and (24) below

$$\hat{W}/\hat{x} = -\theta_{Ky}/\Delta \quad (22)$$

$$\hat{r}/\hat{x} = \theta_{Ly}/\Delta \quad (23)$$

$$\hat{p} = (\theta_{Ly} - \theta_{Lx})/\Delta \quad (24)$$

$$\text{where } \Delta \equiv \theta_{Lx} - \theta_{LF} \quad (25)$$

Then logarithmically differentiating the two factor market-clearing equations ((15) and (16)), we can solve for \hat{Y} and \hat{n} in terms of \hat{x} (obtain (28) from equations (26) and (27) below after substituting for \hat{W} and \hat{r} from (22), (23) and (25)).

$$\delta_{Ly}\hat{Y} + \delta_{Lx}\hat{x} + (1 - \delta_{Ly})\hat{n} = (\hat{W} - \hat{r})[\delta_{Ly}\theta_{Ky}\epsilon_y + \delta_{Lx}\theta_{Kx}\epsilon_x + \delta_{LF}\theta_{KF}\epsilon_F] \quad (26)$$

$$\delta_{Ky}\hat{Y} + \delta_{Kx}\hat{x} + (1 - \delta_{Ky})\hat{n} = -(\hat{W} - \hat{r})[\delta_{Ky}\theta_{Ly}\epsilon_y + \delta_{Kx}\theta_{Lx}\epsilon_x + \delta_{KF}\theta_{LF}\epsilon_F] \quad (27)$$

$$\begin{aligned} \hat{n}/\hat{x} = & \left\{ \Delta(\delta_{Ly} - \delta_{Ky}) \right\}^{-1} \\ & \left\{ \delta_{Ly} \left\{ \delta_{Ky}\epsilon_y + \delta_{Kx}(\theta_{Lx}\epsilon_x - \Delta) + \delta_{KF}\theta_{LF}\epsilon_F \right\} + \left\{ \delta_{Ky} \left\{ \delta_{Lx}(\theta_{Kx}\epsilon_x + \Delta) + \delta_{LF}\theta_{KF}\epsilon_F \right\} \right\} \right\} \end{aligned} \quad (28)$$

Now

$$Z \equiv W\bar{L} + tm^*p^*x^* \quad (29)$$

$$\hat{Z} = \hat{W} + \alpha(1 - \beta)dt \quad (30)$$

$$\hat{Z} = -\theta_{Ky}\Delta^{-1}\hat{x} + \alpha(1 - \beta)dt \quad (31)$$

where α is the share X in GNP, and β is the share of domestic brands in the total expenditure on the differentiated goods. In equation (29) the last term on the right hand side is the rebated tariff revenue.

Then finally we can obtain \hat{x} in terms of the increase in the price of foreign brands due to the tariff (recognizing that \hat{n} depends only on \hat{x} from (28) above).

$$\left[1 + (\sigma - (\sigma - 1)\beta)(\theta_{Ly} - \theta_{Lx})\Delta^{-1} + \theta_{Ky}\Delta^{-1} \right] \hat{x} + \beta\hat{n} = \sigma(1 - \beta)dt \quad (32)$$

Logarithmically differentiating equation (6), we obtain

$$\hat{P} = \beta\hat{p} + \beta(1 - \sigma)^{-1}\hat{n} + (1 - \beta)dt \quad (33)$$

Finally the effect on welfare (from (5)) is given by

$$\hat{V} = -\alpha\hat{P} + \hat{Z} \quad (34)$$

Note that \hat{V} has the same sign as the usual real income change in international

trade theory (i.e., $dU/(\delta U/\delta Z)$).

If we assume that the homogeneous good is the most labour intensive followed by the variable cost component and the fixed cost component being the least labour intensive³, then from equation (28), we expect for high elasticities of substitution in production ε_i 's ($i = y, x, F$), $\hat{n}/\hat{x} > 0$ ⁴ and from equation (32) $\hat{x}/dt > 0$.

We know that the rebated tariff just compensates the consumer for the rise in the price of the importables due to the tariff (from (31), (33) and (34), it can easily be checked that the direct terms involving dt cancel out). Therefore the effect on welfare of the tariff is given by (35)

$$\hat{V} = -\alpha \hat{P} + \hat{Z} = -\alpha\beta(1-\sigma)^{-1}(\hat{n}/dt) + \{\alpha\beta(\theta_{Ky} - \theta_{Kx}) - \theta_{Ky}\} \Delta^{-1}(\hat{x}/dt) \quad (35)$$

In equation (35) we see that the final term is negative—a rise in output per brand x , raises the price of each brand p and it lowers wages, which constitutes the only return accruing to domestic factors of production. But for high elasticities of substitution in production ε_i ($i=y, x$ and F), the tariff also causes entry—a rise in n . This in turn causes P to fall, ceteris paribus. While the effect on welfare of a tariff is ambiguous, it is easy to check that either if the effect of an entry on the price index is small (say, σ is high), or if consumers do not have a taste for diversity⁵ e.g., if the price index is given by

$$P = \left[n^{-1} \beta \sum_{i=1}^n p_i^{1-\sigma} + n^{*-1} (1-\beta) \sum_{j=1}^{n^*} p_j^{*1-\sigma} \right]^{\frac{1}{1-\sigma}} \quad (36)$$

As a consequence of the tariff the size of the domestic differentiated goods sector (given by $n.x$) expands. We see that because that sector is capital intensive, a tariff raises the incomes of the factor which that sector is intensive in—capital—and lowers the return to the other factor—labour. This is consistent with the Stolper-Samuelson Theorem. Gross national product falls because the factor that loses is domestically owned and the factor that gains is foreign-owned. In addition, prices of domestic brands rise, and unless this is swamped by the effect of entry, the price index rises. Welfare falls as a consequence.

4. A tariff on the imported brands with mobile capital

If rate of return on capital is fixed abroad, then $\hat{r} = \hat{W} = \hat{P} = \hat{x} = 0$ from equations

³ This implies $\theta_{Ly} > \theta_{Lx} > \theta_{LF}$ and $\delta_{Ly} > \delta_{Lx}$.

⁴ Check that if the ε 's are all zero (i.e., technologies are Leontief in all the sectors), then under the assumption of this section n and x are inversely related.

⁵ With the price index given in equation (36), there is no effect of a tariff in the case analyzed in section 4.

(19), (20) and (21) above. Equation (32) now determines n with

$$\hat{n} = \sigma(1 - \beta)\beta^{-1} dt \quad (37)$$

We see that when capital is mobile and all of the capital is foreign-owned, an increase in the tariff rate on the imported brands cannot change the wage rate, the price per brand and the output per brand of the domestic differentiated goods sector. The excess demand for these is met solely through entry as equation (37) shows. The effect of entry is proportionally greater on the price index than the initial increase in prices due to increased price of imported brands—this is due to the fact entry is caused by both a substitution of domestic brands for foreign brands and the effect on income of rebated tariff revenue. So in equation (38) below the price index falls.

$$\hat{P} = (1 - \beta)(1 - \sigma)^{-1} dt \quad (38)$$

The effect on welfare is given by substituting equation (38) in equation (34)

$$\hat{V} = \alpha(1 - \beta)\sigma(\sigma - 1)^{-1} dt \quad (39)$$

The effect of a tariff on welfare in equation (39) is solely due to the fall in the price index—since the rebated tariff revenue just compensates the consumers for the rise in the price of the foreign brands due to the tariff. Note that the framework of this section is identical to that of Venables (1987), who uses a one-factor model. Here we have two factors of production but one of them is foreign-owned. Hence, its international return ties down wages, prices of domestic brands and output per brand. The model, in spite of being a two sector model, starts to resemble a Ricardian one-factor model, where capital intensities etc. are frozen!

5. Conclusions

In an imperfectly competitive model we showed the desire to protect the differentiated goods sector—which can be identified with the industrial sector—could have different results depending on how mobile capital is. Protection could be immiserizing if capital is immobile. Increased factor returns are appropriated by factors owned abroad and domestic factor incomes fall, while the price increases are passed on to domestic consumer. Of course, entry takes place that can modify but unlikely to overturn (for reasonable parameter values) the effect on prices. But if capital is mobile the domestic economy benefits since now its factor incomes do not change, prices of domestically produced brands of the differentiated good also is invariant while entry lowers the price index.

As mentioned in the introduction this could have had some serious implications for the strategy for industrialisation followed in the third world, as well as for the sequencing of liberalization debate.

References

- Atkinson, Anthony B., and Joseph E. Stiglitz, J.E. (1980) : *Lectures in Public Economics*, McGraw-Hill, New York.
- Ethier, Wilfred (1982) : National and International Returns to Scale in the Modern Theory of International Trade, *American Economic Review* 72:389-405.
- Helpman Elhanan and Paul R. Krugman (1989) : *Trade Policy and Market Structure*, Cambridge: MIT Press.
- Krugman, Paul R.(1979) : Increasing Returns, Monopolistic Competition and International Trade, *Journal of International Economics* 9 :469-479.
- Matsuyama, Kiminori (1989) : Modelling Complimentarity in Monopolistic Competition, *Bank of Japan Monetary and Economic Studies* 11 : 87-109.
- Sen, Partha, Arghya Ghosh and Abheek Barman (1997) : The Possibility of Welfare Gains with Capital Inflows in a Small Tariff-Distorted Economy, *Economica* 64 : 345-352.
- Venables, Anthony J. (1982) : Optimal Tariffs for Trade in Monopolistically Competitive Commodities, *Journal of International Economics* 12 : 224-241.
- Venables, Anthony J (1987) : Trade and Trade policy with Differentiated Products: A Chamberlinian-Ricardian Model, *Economic Journal* 97 : 700-717.

Illegal Immigration, Informal Sector and Development Policies in a Dual Economy

Shigemi Yabuuchi*

Abstract

We analyze the effects of various development policies in a dual economy which is characterized by the existence of both illegal immigration and an informal sector. We consider wage subsidies, the probability of detection and the penalty for illegal immigrants. The implications of these policies for national welfare, unemployment and illegal immigrants are examined, particular attention being paid to the relation between the informal sector and illegal immigrants.

JEL Classification : F22, O12, O17.

Keywords : Harris-Todaro model, Informal sector, International migration, Unemployment; Welfare.

1. Introduction

Harris and Todaro (1970) have given a new dimension to the problem peculiar to a dual economy. The dual economy has a characteristic feature such as the coexistence of an industrialized urban sector and a traditional rural sector along with widespread urban unemployment and labor movement between the sectors. They developed an ingenious model for explaining this phenomenon with the introduction of a migration equilibrium condition. The distinguishing feature of the condition is that, in the labor market equilibrium, the actual rural wage rate is equated with the expected urban wage rate. Various aspects of the Harris-Todaro model (hereafter, HT model) are investigated intensively by both trade and development theorists, for example, Bhagwati and Srinivasan (1974), Batra and Naqvi (1987), Beladi and Naqvi (1988), Chao and Yu (1996), Corden and Findlay (1975), Gupta (1993), Khan (1980), Neary (1991), Hazari and Sgro (1991) and Yabuuchi (1993).

Another important aspect of the labor market in developing countries is the existence of informal sectors. In the standard HT model, it is supposed that those workers who are unable to find a high-wage urban job remain unemployed in the area. In reality, however, a substantial portion of the urban labor force is absorbed in the urban informal sector which is typically characterized as one that has as easy entry, the lack of a stable employer-employee relationship and low-wage. These activities include final consumption goods and various services such as a house-servant, a street vendor and a shoe-black. Considering the existence of the informal sector, therefore, the HT model must be modified to incorporate the sector. There have been some studies which

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incorporate an urban informal sector, for example, Chaudhuri (2000), Fields (1975), Grinols (1991), Chandra and Khan (1993), Quibria (1988) and Din (1996).

On the other hand, several countries import legal and/or illegal immigrants. For example, the United States receives immigrants from Mexico and Caribbean nations, Asian NIEs from the relatively less developed neighboring countries, and India from Bangladesh and Nepal. Each foreign immigrant has two aspects for the host country, labor force and a resident. Most countries appreciate the former aspect of the immigrants but the latter since they bring about various kinds of costs for the host country, for example, education, medical care, keeping peace and order, and so on. Though most countries more or less restrict foreign immigrants, there are many illegal immigrants in the advanced countries and prosperous cities in the world. They hardly get job in the formal sectors because of their social position. Thus, (illegal) immigrants generally work in the informal sector since domestic workers do not want to work there. Informal sectors are also characterized by so-called three-(or four)-dimensional jobs, i.e., *dirty*, *dangerous*, *dull*, and *demanding*. There are many studies on illegal immigration in the trade model, for example, Ethier (1986), Bond and Chen (1987), Djajic (1987), Yoshida (2000), and Kondoh (2000).

Illegal immigration and unemployment have been discussed by Ethier (1986) and Djajic (1987) in a different context. On the other hand, Djajic (1997) has studied the relation between illegal immigration and the underground economies of developed countries in the model without unemployment. However, the link between illegal immigration and urban unemployment through an informal sector has not been discussed so far. It seems appropriate, therefore, that we reformulate the HT model with both an informal sector and illegal immigrants, and examine the implications of various policies for unemployment, illegal immigrants and welfare. We attempt to include the informal sector and illegal immigrants into the HT model, drawing to some extent on the approach developed by Hazari and Sgro (2000) in their analysis of border enforcement and growth. Thus, our analysis may be applicable to foreign immigration from less developed economies to relatively industrialized neighboring economies that have still dual structure, such as Asian NIEs and India.

Our main findings are as follows. A wage subsidy to the agricultural sector increases welfare and decreases urban unemployment, while keeping the number of illegal immigrants constant. A wage subsidy to the manufacturing sector decreases illegal immigrants. The effect of the manufacturing wage subsidy on welfare and urban unemployment are conditional. We identify the conditions for the definite results and interpret them. A wage subsidy to the informal sector improves welfare at the risk of increasing illegal immigrants. The implications of the probability of detection and the penalty for those who are caught are also examined. It is shown that the two policies have qualitatively same results. There is a trade-off between the effects of the policies

on illegal immigrants and welfare. If an increase in the probability of detection (or alternatively, an increase in the penalty) succeeds in reducing illegal immigrants, then it decreases welfare. On the other hand, if the border enforcement policy increases illegal immigrants, it may improve welfare. The effect on urban unemployment is not favorable.

The rest of the paper is organized as follows. Section 2 presents the model and basic assumptions. Section 3 examines the effect of wage subsidies on welfare, urban unemployment and foreign immigrants. The implications of the probability of detection and the penalty are discussed in section 4. Finally, concluding remarks can be found in section 5.

2. The model and assumptions

We introduce an urban informal sector into the basic HT model. It is assumed that there are three sectors in a small country: manufacturing sector (sector m), agricultural sector (sector a), and informal sector (sector i). The manufacturing and informal sectors are in the urban area while the agricultural sector is in the rural area. We assume that the usual constant-returns-to-scale technologies with positive and diminishing marginal products. Each sector uses labor and capital specific to the respective sector. Thus, the production functions may be written

$$X_j = F^j(L_j, K_j), \quad j = a, m, \quad (1)$$

where L_j and K_j are the labor and capital employed in sector j , respectively. An agricultural good is exported at the normalized international price of unity. Good m is an importable good with world price p . The informal sector produces exportable good i , such as primitive clothing and processed foods, at the fixed world price q . Foreign immigrants are hardly employed in the formal sectors because of their low-skill and social status. Therefore, it is natural to assume that foreign immigrants are employed in the informal sector and they are specific to the sector. Thus, the production function is

$$X_i = F^i(L_i + L^*, K_i), \quad (2)$$

where L^* is the number of successful immigrants, that is, foreign immigrants who are not caught.

We assume that the real wage rate in manufacturing (w_m) is rigid due to some political and institutional considerations while wages in the agricultural and informal sectors (w_a and w_i , respectively) are flexible. The labor allocation mechanism of this revised HT model shows that in the labor market equilibrium, the rural wage equals the expected wage income in the urban area. Let L_u be unemployed labor in the urban area. Since the expected wage in the urban area is $(w_m L_m + w_i L_i) / (L_m + L_i + L_u)$, the labor allocation mechanism between rural and urban areas is expressed as

$$(w_m L_m + w_i L_i) / (L_m + L_i + L_u) = w_a \quad (3)$$

or alternatively,

$$w_m + \mu w_i = w_a (1 + \mu + \lambda),$$

where $\mu = L_i / L_m$ and $\lambda = L_u / L_m$. It is also assumed that the expected wage in the informal sector equals that in manufacturing sector, that is,

$$w_m L_m / (L_m + L_i + L_u) = w_i L_i / (L_m + L_i + L_u) \quad (4)$$

or by definitions

$$w_m = \mu w_i.$$

This shows the labor allocation mechanism between the manufacturing and informal sectors within the urban area. Similar labor allocation mechanism is employed in Yabuuchi (1999) to discuss the welfare effect of foreign direct investment.

Therefore, the labor market equilibrium is expressed, in addition to (3) and (4) above, as

$$(1 - s_a) w_a = F_L^a \quad (5)$$

$$(1 - s_m) w_m = p F_L^m \quad (6)$$

$$(1 - s_i) w_i = q F_L^i \quad (7)$$

where $F_L^j = \partial F^j / \partial L_j$, and s_j is the wage subsidy to sector j ($j=a, m, i$). The employment condition in the labor market is

$$L_a + L_m + L_i + L_u = L$$

$$\text{or} \quad (8)$$

$$L_a + L_m (1 + \mu + \lambda) = L$$

where L is the endowment of labor.

Let w^* be the foreign wage rate, ρ the probability of detection, and Z the penalty for those who are caught. It is assumed that these variables are constant for political and institutional considerations. The equilibrium of international labor movement can be formalized as

$$(1 - \rho) w_i + \rho (w^* - Z) = w^* \quad (9)$$

Since L^* is the number of successful immigrants, the number of those who are caught is $\rho L^* / (1 - \rho)$. The host government receives $Q = \rho L^* Z / (1 - \rho)$ as the penalty. On the other hand, it must spend some amounts for detection, which is a function of the probability of detection, i.e., $T = \phi(\rho)$. We assume that the function has the following properties: $\phi(0) = 0$, $\phi(1) = \infty$, $\phi'(\rho) > 0$, and $\phi''(\rho) > 0$.

Thus, national income is defined as

$$Y = X_a + pX_m + qX_i - w_i L^* + Q - T \quad (10)$$

This completes the specification of the HT model with the informal sector and illegal immigrants. We have seven unknown variables, $w_a, w_i, L_a, L_m, L_i, L_u$ and L^* , which are solved by seven equations (3) – (9) for given parameters.

3. Wage subsidy

In this section we analyze the effects of wage subsidies on unemployment, foreign immigrants and welfare in the revised HT model. Wage subsidies are used extensively as a development policy, hence discussed intensively in the literature. It is assumed that these subsidies are collected in a lump-sum fashion and given to the respective sectors.

(3-1) Agricultural wage subsidy

Labor movement from rural to urban sectors are largely motivated by the wage gap between the areas. Therefore, it is expected that a wage subsidy to the agricultural sector keeps labor at the rural area, hence reduces urban unemployment. In fact, comparative statics (given in the Appendix) shows that $dL_u/ds_a < 0$. This result is rather straightforward.

Now, let U denote the social utility which a community derives from its consumption of three goods, D_j ($j=a, m, i$). Then,

$$U = U(D_a, D_m, D_i) \quad (11)$$

The balance of trade equilibrium requires that

$$D_a + pD_m + qD_i = X_a + pX_m + qX_i - w_i L^* + Q - T \quad (12)$$

Differentiating (1), (2), (11) and (12), we have

$$\begin{aligned} dU/U_a = & (L - L_a)dw_a - \{L_i + L^*\}dw_i + [\rho Z/(1-\rho)]dL^* \\ & + [ZL^*/(1-\rho)^2 - \phi']d\rho + [L^*\rho/(1-\rho)]dZ \end{aligned} \quad (13)$$

Thus, the change in welfare depends on the changes in two flexible wage rates, foreign immigrants and border enforcement policies. In the present case of agricultural wage subsidy, it can be seen that w_i is constant. We assume that Z and ρ are fixed in this section. Therefore, the change in welfare depends on the changes in the agricultural wage and the foreign immigrants. We can show that $dw_a/ds_a > 0$ and $dL^*/ds_a = 0$. This leads to the following proposition

Proposition 1. *If the informal sector accepts foreign immigrants, a wage subsidy to the rural sector decreases urban unemployment and improves welfare,*

while keeping the number of illegal immigrants constant.

An agricultural wage subsidy raises the rural wage. This keeps rural labor stay in the area and reduces urban unemployment since the city becomes relatively less attractive owing to the wage increase. Furthermore, the subsidy improves welfare because of the increase in labor income.

Since the informal wage is fixed through the international labor allocation mechanism (shown in (9)), the employment in the informal sector (L_i) does not change under the constant manufacturing wage (w_m) and employment (L_m). Total employment in the sector ($L_i + L^*$) is constant when the informal wage is fixed. Thus, the number of foreign immigrants (L^*) also remains constant.

(3-2) Manufacturing wage subsidy

A manufacturing wage subsidy is commonly used to accelerate development by promoting urban manufacturing production. Thus, it is interesting to examine the effects of this policy on unemployment, welfare and illegal immigrants.

It can be shown that

$$dw_a/ds_m = -2w_i(w_m)^2(1-\rho)F_{LL}^a qF_{LL}'/\Delta > 0 \quad (14)$$

and

$$dL^*/ds_m = -(w_m)^2(1-\rho)qF_{LL}'\Omega/\Delta < 0 \quad (15)$$

where $F_{LL}^j = \partial F_L^j / \partial L_j$, ($j=i,a$), $\Omega = \{w_a - (L - L_a)F_{LL}^a\}$, and Δ is the value of the determinant of the coefficient matrix of the system,

$$\Delta = -w_i(1-\rho)pF_{LL}^m qF_{LL}'\Omega < 0$$

We can show that $dw_i/ds_m = 0$. Thus, substituting (14) and (15) into (13) and keeping Z and ρ constant, we have

$$dU/U ds_m = -(w_m)^2 qF_{LL}' \{w_a \rho Z + (w^* + w_i)(1-\rho)(L - L_a)F_{LL}^a\} / \Delta \quad (16)$$

Though the effect of the subsidy on welfare is generally indeterminate, (16) suggests the necessary and sufficient condition for the increase in welfare. That is, we can show that $dU/ds_m > 0$ if and only if

$$\xi_a > l_a \rho Z / (w^* + w_i)(1-l_a)(1-\rho),$$

where $l_a = L_a/L$, and $\xi_a = -(L_a/w_a)F_{LL}^a$ is the elasticity of the rural wage with respect to the employment.

The effect on unemployment can be shown as

$$dL_u/ds_m = w_m w_i (1-\rho) qF_{LL}' \{\lambda w_a + (1+\mu)(L - L_a)F_{LL}^a\} / \Delta \quad (17)$$

Thus, the effect of the subsidy on urban unemployment is also conditional. We can

see from (17) that $dL_u/ds_m < 0$ if and only if

$$\xi_a > \lambda_a / (1 + \mu)(1 - l_a)$$

Thus, we have the following proposition.

Proposition 2. *If the informal sector accepts foreign immigrants, a wage subsidy to the manufacturing sector improves welfare if and only if*

$$\xi_a > l_a / w^*(1 - l_a)(1 - \rho),$$

and it decreases urban unemployment if and only if

$$\xi_a > \lambda_a / (1 + \mu)(1 - l_a).$$

while it decreases illegal immigrants unconditionally.

The proposition shows that a manufacturing wage subsidy may be a recommended policy under certain conditions. The elasticity of the rural wage with respect to the employment (ξ_a) will be the key variable.

The welfare depends on the changes in the rural wage and foreign immigrants as shown above. The former contributes to improve welfare through the increase in labor income. The larger the elasticity, the larger is the increase in the rural wage rate, so the larger is the beneficial effect.

On the other hand, the subsidy increases the domestic labor employed in the informal sector along with the manufacturing employment. This decreases foreign immigrants since the increased domestic workers in the informal sector replace some of the foreign immigrants. Thus, the subsidy puts downward pressure on welfare through the decrease in the penalty income. There is a trade-off between illegal immigrants and welfare. If the elasticity is larger than the critical value stated in the condition, the manufacturing wage subsidy eventually improves welfare.

The change in unemployment also depends on the elasticity of the rural wage with respect to the employment. The employment expands in the urban sectors, while it contracts in the rural sector. The larger the elasticity, the smaller is the decrease in the rural employment for a given increase in the rural wage rate. If the decrease in the rural employment is smaller than the increase in the urban employment, the subsidy reduces urban unemployment. The proposition provides the critical value of the elasticity for the decrease in urban unemployment.

(3-3) Informal wage subsidy

Now consider the implication of a wage subsidy to the informal sector for the variables. It may have some difficulty to consider such a policy since the informal sector is conceptually out of the authority's control. The wage subsidy may not be feasible owing to the government capacity and/or the administrative costs. To apply

the results to the real economy, therefore, some qualifications need to be made in these respects.

We can show that $dw_o/ds_i = 0$ and $dL_u/ds_i = 0$, and $dL^*/ds_i > 0$. Thus, the following proposition is immediate.

Proposition 3. *If the informal sector accepts foreign immigrants, a wage subsidy to the informal sector increases illegal immigrants and improves welfare, while it leaves urban unemployment constant.*

An informal wage subsidy expands the total employment in the informal sector. The employment of domestic labor (L_i) is fixed because it is determined through the urban labor allocation mechanism under the constant informal wage rate. Thus, the subsidy induces an inflow of illegal immigrants. This improves welfare owing to the increase in the penalty income. Note that the subsidy does not change urban unemployment. This is because the informal wage subsidy does not affect the domestic labor allocation.

4. Border enforcements

A foreign immigrant plays two roles in the host country, i.e., (cheap) labor force and a resident of the country. The former contributes to the economy, especially by taking the 3-dimensional jobs, while the latter brings about various kinds of costs such as education, medical care, and so on. If the latter effect is dominant for the country, she may wish to restrict foreign immigrants by border enforcements. In the present set-up, we consider the increase in the probability of detection and/or the increase in the penalty for those who are caught as the policies to reduce illegal immigrants. It can be seen from (9) that the increase in the probability of detection has qualitatively same effect on the economy as the increase in the penalty. Thus, it is sufficient to examine one of the policies. We examine the effects of the implications of the increase in the probability of detection for urban unemployment, foreign immigrants and welfare.

Comparative statics shows that $dL_u/d\rho > 0$ and

$$dL^*/d\rho = Aw_i p F_{LL}'' [1 - \xi_i L_i / (L_i + L^*)] \Omega / \Delta \quad (18)$$

where $A = w^* - Z - w_i = -Z/(1 - \rho) < 0$, and $\xi_i = -(L_i + L^*) q F_{LL}' / w_i$ is the elasticity of the informal wage with respect to the employment. It can be seen that $dL^*/d\rho < (>) 0$ according to $\xi_i < (>) (L_i + L^*) / L_i$.

The border enforcement policy reduces the expected wage rate in the informal sector. Thus, the informal wage rate increases to restore the initial level of the expected wage rate. This decreases both the domestic employment (L_i) and foreign immigrants (L^*). The domestic employment decreases at the same rate as the wage rate according to the labor allocation mechanism between the urban sectors (shown in (4)) under constant w_u and L_u . Therefore, if the wage rate is elastic with respect to the

employment (i.e., if the elasticity is small), then the total employment in the sector may decrease more than the domestic employment. The condition provides the critical value that the decrease in total employment in the sector is larger (smaller) than that in the domestic employment, hence foreign immigrants decrease (increase).

Let us turn to the effect of the border enforcement on welfare. Comparative statics shows that $dw_a/d\rho = 0$ and

$$dw_i/d\rho = Aw_i p F_{LL}'' q F_{LL}' \Omega / \Delta = Z / (1 - \rho)^2 > 0 \quad (19)$$

By substituting (18) and (19) into (13), we have

$$\begin{aligned} dU/U_a d\rho &= [\rho Z / (1 - \rho)] dL^* / d\rho - (L_i + L^*) dw_i / d\rho + [L^* Z / (1 - \rho)^2 - \phi'] \\ &= [\rho Z^2 \{1 - \xi_i L_i / (L_i + L^*)\} / (1 - \rho) - q F_{LL}' \{L_i Z + (1 - \rho)^2 \phi'\}] / (1 - \rho)^2 q F_{LL}' \end{aligned} \quad (20)$$

since $L^* dw_i / d\rho = L^* Z / (1 - \rho)^2$.

The effects of the change in the penalty for the unsuccessful immigrants are examined similarly. It can be shown that the results are qualitatively same as those obtained for the change in the probability of detection. Thus, we obtain the following proposition.

Proposition 4. *If the informal sector accepts foreign immigrants, an increase in the probability of detection (or an increase in the penalty for those who are caught) decreases illegal immigrants and welfare if $\xi_i < (L_i + L^*) / L_i$, while it increases urban unemployment unconditionally.*

The increase in the probability of detection increases the informal wage rate in order to compensate the increase in the expected wage rate through the international labor allocation mechanism (9). This reduces the employment of domestic labor in the informal sector, hence increases urban unemployment. Thus, the income loss due to the increase in unemployment ($-L_i dw_i / d\rho$) leads to reduce welfare. The increase in the cost to enforce the detection ($-\phi'$) also decreases welfare. Therefore, the total effect depends on the change in foreign immigrants.

The enforcement of detection decreases foreign immigrants and leads to the loss in penalty income if the elasticity of the informal wage with respect to the employment is smaller than $(L_i + L^*) / L_i$. In this case, therefore, this border enforcement policy eventually leads to a loss in welfare. Roughly speaking, if the informal wage is inelastic relative to the employment, the policy to increase border enforcement succeed to reduce illegal immigrants at the risk of both the increase in urban unemployment and the decrease in welfare. Conversely, if $\xi_i > (L_i + L^*) / L_i$ and

$$\rho Z^2 \left\{ 1 - \xi_i L_i / (L_i + L^*) \right\} / (1 - \rho) > q F'_{LL} \left\{ L_i Z + (1 - \rho)^2 \phi' \right\}$$

then the positive effect of the penalty income outweighs the negative effects of unemployment and the enforcement cost, hence the policy improves welfare.

5. Concluding remarks

We have examined the effects of wage subsidies and border enforcements on unemployment, illegal immigrants and welfare in a dual economy that is characterized by the existence of both illegal immigrants and an informal sector. Our results are summarized in the following table, where +, □, and 0 shows that the relation is positive, negative, and nothing, respectively, and the bracket means that the relation is conditional. The rural wage subsidy is effective to reduce urban unemployment and improve welfare, while the informal wage subsidy is useful just to improve welfare. The manufacturing wage subsidy may be the most effective policy to attain all three goals under certain conditions. There is a serious trade-off between the effects on illegal immigrants and welfare in the case of the border enforcement policies. Thus, policy makers must select the appropriate policy considering relative importance among the policy goals.

Table 1. Summary of the results

	Immigrations	Unemployment	Welfare
Rural Subsidy	0	□	+
Manufacturing Subsidy	□	□□□	□+□
Informal Subsidy	+	0	+
Probability of detection (Penalty)	(□)	□	□□□

We do not consider explicitly various social costs of foreign immigrants, which include education, medical care, social security and so on. It would be appropriate to incorporate these considerations into the present model. We shall develop such a version of the HT model for studying the social costs of illegal immigrants in the future.

Appendix

In this appendix, we derive the mathematical expression used in the text. Differentiating (1)–(9) and setting s, s be equal zero initially, we have

$$\begin{bmatrix} F_{LL}^a & 0 & 0 & 0 & 0 & -1 & 0 \\ 0 & pF_{LL}^m & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & qF_{LL}^i & 0 & qF_{LL}^i & 0 & -1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ w_a & 2w_m & 0 & 0 & 0 & -(L - L_a) & 0 \\ 0 & w_m & -w_i & 0 & 0 & 0 & -L_i \\ 0 & 0 & 0 & 0 & 0 & 0 & (1 - \rho) \end{bmatrix} \begin{bmatrix} dL_a \\ dL_m \\ dL_i \\ dL_u \\ dL^* \\ dw_a \\ dw_i \end{bmatrix} = \begin{bmatrix} -w_a ds_a \\ -w_m ds_m \\ -w_i ds_i \\ dL \\ w_a dL \\ 0 \\ -Ad\rho + \rho dZ \end{bmatrix} \quad (A1)$$

where $F_{LL}^j = \partial F_L^j / \partial L_j$, ($j = i, a$), and $A = w^* - Z - w_i < 0$.

Solving (A1) for dw_a with respect to ds_a , we obtain

$$dw_a / ds_a = -(w_a)^2 w_i (1 - \rho) p F_{LL}^m q F_{LL}^i / \Delta > 0 \quad (A2)$$

where Δ is the value of the determinant of the coefficient matrix of the system,

$$\Delta = -w_i (1 - \rho) p F_{LL}^m q F_{LL}^i \Omega < 0, \text{ and } \Omega = \{w_a - (L - L_a) F_{LL}^a\}.$$

Other expressions are derived similarly.

$$dL_u / ds_a = w_a w_i (L - L_a) (1 - \rho) p F_{LL}^m q F_{LL}^i / \Delta < 0, \quad (A3)$$

$$dL^* / ds_i = (w_i)^2 (1 - \rho) p F_{LL}^m \Omega / \Delta > 0, \quad (A4)$$

$$dL_u / d\rho = AL_i p F_{LL}^m \Omega / \Delta > 0. \quad (A5)$$

$$dL_i / d\rho = -AL_i p F_{LL}^m q F_{LL}^i \Omega / \Delta < 0. \quad (A6)$$

References

- Batra, R. N. and N. Naqvi (1987): Urban Unemployment and the Gains from Trade, *Economica* 54, 381-95.
- Beladi, H. and N. Naqvi (1988): Urban Unemployment and Non-Immiserizing Growth, *Journal of Development Economics* 28, 365-76.
- Bhagwati, J. N. and T. N. Srinivasan (1974): On Reanalysing the Harris-Todaro Model: Policy Rankings in the Case of Sector-Specific Sticky Wages, *American Economic Review* 64, 502-508.
- Bond, E. W. and T.-J. Chen (1987): The Welfare Effects of Illegal Immigration, *Jour-*

- nal of International Economics* 23, 315-328.
- Chaudhuri, S. (2000): Rural-urban migration, the informal sector, urban unemployment, and development policies: a theoretical analysis, *Review of Development Economics* 4, 353-364.
- Chandra, V. and M. A. Khan (1993): Foreign Investment in the Presence of an Informal Sector, *Economica* 60, 79-103.
- Chao, C. C. and E. S. H. Yu (1996): International Capital Mobility, Urban Unemployment and Welfare, *Southern Economic Journal* 62, 486-92.
- Corden, W. M. and R. Findlay (1975): Urban Unemployment, Intersectoral Capital Mobility and Development Policy in a Dual Economy, *Economica* 42, 59-78.
- Din, M. (1996): International Capital Mobility and Development Policy in a Dual Economy, *Review of International Economics* 6, 185-201.
- Djajic, S. (1987): Illegal Aliens, Unemployment and Immigration Policy, *Journal of Development Economics* 25, 235-249.
- Djajic, S. (1997): Illegal Immigration and Resource Allocation, *International Economic Review* 38, 97-117.
- Ethier, W. J. (1986): Illegal Immigration □ The Host Country Problem, *American Economic Review* 76, 56-71.
- Fields, G. (1975): Rural-Urban Migration, Urban Unemployment and Job-Search Activity in Less Developed Countries, *Journal of Development Economics* 2, 165-188.
- Gupta, M. R. (1993): Rural-urban Migration, Informal Sector and Development Policies, *Journal of Development Economics* 41, 137-151.
- Harris, J. R. and M. Todaro (1970): Migration, Unemployment and Development: A Two-Sector Analysis, *American Economic Review* 60, 126-142.
- Hazari, B. R. and P. M. Sgro (1991): Urban-Rural Structural Adjustment, Urban Unemployment with Traded and Non-traded Goods, *Journal of Development Economics* 35, 187-96.
- Hazari, B. R. and P. M. Sgro (2000): Illegal Migration, Border Enforcement, and Growth, *Review of Development Economics* 4, 258-267.
- Khan, M. A. (1980): Dynamic Stability, Wage Subsidies and the Generalized Harris-Todaro Model, *Pakistan Economic Review* 19, 1-24.
- Kondoh, K. (2000): Legal Migration and Illegal Migration □ The Effectiveness of Qualitative and Quantitative Restriction Policies, *Journal of International Trade and Economic Development* 9, 227-245.
- Neary, J. P. (1981): On the Harris-Todaro Model with Intersectoral Capital Mobility, *Economica* 48, 219-34.
- Quibria, M. G. (1988): Migration, Trade Union, and the Informal Sector: A Note on Calvo, *International Economic Review* 29, 557-563.
- Yabuuchi, S. (1993): Urban Unemployment, International Capital Mobility and Devel-

opment Policy, *Journal of Development Economics* 41, 399-403.

Yabuuchi, S. (1999): Foreign Direct Investment, Urban Unemployment and Welfare, *Journal of International Trade and Economic Development* 8, 359-371.

Yoshida, C. (2000) *Illegal Immigration and Economic Welfare*. Physica-Verlag, Heidelberg.

NON-TRADED SECTOR AND WAGE INEQUALITY IN A DEVELOPING ECONOMY

Rajat Acharyya* and Sugata Marjit**

Abstract

Trade liberalization in the poor countries, according to the celebrated Stolper-Samuelson theorem, should improve the relative wage of the unskilled workers. But scattered empirical evidence shows increasing wage inequality as reflected in the widening wage-gap between the skilled and unskilled workers even for the developing countries. We argue in terms of a general equilibrium model consistent with the diversified trade patterns and production structure of the developing countries that due to production of non-traded goods employing a significant chunk of local labour force, trade liberalization may indeed lead to such a situation. We recast the neo-classical trade-income distribution relationship through proper characterisation of developing country labour markets.

JEL Classification : F1, F11, F12.

Keywords : Wage inequality, Trade liberalization, Non-traded good, General equilibrium.

Introduction

Of late economists are worried over trade-induced growing wage inequality in most part of the globe. Such concerns have arisen due to a noticeable empirical phenomenon that suggests a considerable decline in the income of the unskilled labour and/or a decline in their employment relative to more skilled segment of the workforce. This have happened in US and in Europe over the last twenty years and has roughly coincided with the buoyant phase of international trade and investment. Though inequality is a complex phenomenon, movements in the ratio of unskilled to skilled wage rate and employment are rough indicators of its changes. As such, the widening wage-gap between the skilled and unskilled workers in the US has triggered heated discussions and debates over the possible causes. The active participants include the labour economists as well as the international trade theorists. As neatly summarized in Davis (1998), Krugman (2000), and Jones and Engerman (1996), two underlying causes are identified: Technology related and trade related. The cornerstone of the trade related argument is the Stolper-Samuelson theorem: Increased unskilled labour-intensive imports from countries such as China or Mexico and the consequent fall in the domestic price of the import-competing goods in the US depresses the unskilled wage and raises the skill wage thereby widening the wage-gap. There are, however,

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two major problems with this argument. First, there is no clear empirical evidence regarding the fall in the domestic price of the unskilled labour-intensive import-competing goods in the US which triggers the Stolper-Samuelson result, i.e., causes the relative wage to move against the unskilled labour [Bhagwati (1995), Leamer (1995)]. Also some economists have argued that the widening wage-gap is more due to skill-biased technological progress than anything else [Berman, Bound and Grilliches (1994), Krugman (2000)]. Second, following the Heckscher-Ohlin argument, increased trade with the developed countries (DCs) should imply a narrowing wage-gap in the less developed countries (LDCs) abundant in the unskilled labour. But this has not happened in Latin America [Wood (1997), Robbins (1994a, 1994b)].

The studies by Robbins covering Argentina, Chile, Colombia, Costa Rica and Uruguay, reveal widening of the skill differentials in wages (by the level of education) in almost all these countries contrary to the conventional wisdom. Mexico is another example where the increasing wage-gap during 1984-1990 coincided with the steep decline in the real minimum wage. For Chile, Meller (1998) finds the White-Blue wage differentials going down between 1984 and 1992, whereas Pederson (1998) reports about a study which shows that over the 1980s the wage of the university graduates-high school graduates went up by 56 percent. Beyer et. al. (1999), however, find that openness did raise the premium to skill in Chile during the last two decades of the twentieth century. Such wage-inequality, they argue, is more due to trade-induced changes in production structure of the economy rather than technology transfer or sector-biased technical progress. At the same time there is clear indication in their study that relative supply of college graduates reduces wage-inequality.

For East Asia, on the other hand, the empirical findings available so far point towards a declining inequality. The evidences in other parts of Asia and Africa are not very systematic. Robbins (1994a) finds persistent compression of wage differentials by the level of education in Malaysia from 1973-1989 particularly between university graduates and educated workers. This went on in the early 1990s with the skilled and semi-skilled blue-collar workers in manufacturing sector gaining relative to others.

Though any comprehensive empirical study is yet to come by, some casual empiricism points out similar possibilities in South Asia including India. The impact of the so-called globalization in this region is studied from a broader perspective of growth and poverty by Khan (1998a), Rao (1999) and Tendulkar et.al. (1996). Khan (1998a) finds that the process of expansion in foreign trade and investment in South Asian countries is consistent with rising incidence of poverty in these nations. Typically, if poverty is really on the rise then it must worsen the inequality situation. The scattered evidences available so far indicates similar situation in India. A study by Tendulkar et.al. (1996) has observed that the declining trend in poverty for the Indian

economy was halted right from 1991, the year when major trade and exchange rate reforms were initiated, with a slight reversal in 1994. Rao (1999) finds positive and statistically significant relationship between openness and poverty changes for the developing countries. Countries with declining poverty had on average an openness trend of 0.1% per annum whereas those with rising poverty had an average openness trend of 2.1% per annum.

On the other hand, reports of the Indian Ministry of Labour reveals widening of the range of minimum and maximum wages paid for a particular category of unskilled workers during 1985-1993 across various States. To the extent such a range of wages captures the premium to the semi-skilled among the broader group of unskilled workers, such variations indicate widening intra-skill wage-gap.

Therefore, available evidences point strongly towards widening wage-gap for the Latin American and South Asian countries following significant expansion in international trade in these countries. But what is bothering is that such observations are often at variance with the predictions of the available theories. This, however, is more due to the mind set of the theorists to explore theoretical possibilities that are grounded in an antiquated demonstration of the Heckscher-Ohlin and Stolper-Samuelson (SS) results. An apathy towards having a closer look at the labour markets of the developing countries and a casual treatment of the trade theory, ignoring the possibilities that lie underneath the surface, means committing theories to conclusions which are only artifacts of weak theorization. This is what this paper tries to avoid and for this purpose we suggest a model that can be used in applied work instead of straightjacket application of the SS result to examine the impact of trade liberalization on wage-inequality in the developing countries.

The model that we use departs from the standard trade theory in two important respects. First is the characterization of the labour market. As well documented by Agenor (1996), Cole and Sanders (1985), Fields (1990), Mazumdar (1983, 1993), informal or unorganized sectors provide most of the employment in the developing countries. The 1991 Census Report in India also tells the same story: Share of informal sectors in total employment is almost 90 percent and this has been the general trend during the 1980s and 1990s. Accordingly, these characteristics of the labour markets in the LDCs must be accounted for in examining the trade and wage-inequality nexus.

The second departure is in terms of diverse trade pattern that many developing countries are showing of late in their export baskets. Such diverse trade patterns cannot effectively be captured through an aggregate index of skill-intensity of exports. India's export pattern is one such example revealing the drawback of the aggregate measure. From exporter of primary product at large, India has emerged as a signifi-

cant seller in the international market for softwares which is by any means highly skill-intensive. Gems and Jewellers, another major export item during 1990s, also involve a good deal of skilled labour. Thus despite several agricultural goods being exported, it would not only be unfair but also perverse to assume India's export as relatively unskilled labour intensive while analyzing the effect of terms of trade changes on the wage-gap. Examples of other developing countries are not hard to find.

With such characteristics being incorporated in the model, one major concern of this paper that differentiates it from our earlier attempts [Marjit (1997), Marjit and Acharyya (2000)], however, is to examine the role of non-traded good. It is well known by now that the existence of the non-traded goods, the market for which must clear domestically, significantly alter many standard results of the trade models. Since most of the non-traded production in the LDCs use unskilled labour intensively, any discussion of changes in wage-inequality in the LDCs through trade liberalization cannot be complete without such non-traded goods being taken into account.

The more important issue, however, is the nature of such non-traded sectors. In particular, whether non-traded production is organized in the informal or in the formal sector may appear to be crucial. Essentially the way formal and informal sectors are modelled in the literature, the issue at hand can be rephrased as examining the role of the non-traded production under alternative wage formation assumption: (higher) contractual unskilled wage or fully flexible market-determined unskilled wage. Since the traded sectors compete with the non-traded sectors for the scarce resources they commonly use and the non-traded production by definition must match its domestic demand, trade liberalization induced expansion of activities in the traded sectors will be possible only through a fall in the demand for non-tradeable. This necessitates an increase in the price of non-traded goods and consequent changes in the domestic income distribution. Herein comes the role of the nature of the non-traded sector. If it is a formal sector with a contractual wage, the non-traded price may be determined solely by the cost of production independent of the demand for non-traded good. In such a case demand variation consequent upon trade liberalization induced real income changes alters only the non-traded production. Accordingly any change in the wage gap is triggered by the consequent resource reallocation across the non-traded and traded sectors. But if the non-traded sector is an informal sector, variations in the demand for non-traded good is followed by the changes in both production and price of the non-traded good. Accordingly, trade liberalization will have quite different implications on the wage gap between skilled and unskilled workers.

The purpose of this paper is to focus on these issues. In particular, we examine the role of a non-traded sector in the context of the relationship between factor prices, wage-inequality and trade liberalization which to best of our knowledge has not been

addressed so far. We consider a simple general equilibrium model with a manufacturing export good and an import-competing good using the skilled and unskilled labour respectively along with domestic capital, and agricultural export good produced by a specific factor, land, along with unskilled labour and a non-traded good using only unskilled labour. Agricultural export sector is the informal sector whereas the manufacturing export and import-competing productions are in the formal sectors. The non-traded sector is modelled both as formal and informal sectors in turn. Unskilled workers who do not get jobs in the formal import-competing sector at the contractual wage are absorbed in the informal sector(s) at a lower (flexible) wage.

In this set up we observe that production of goods that cannot be traded by itself alters the relationship between changes in wage inequality and trade liberalization significantly. On the other hand, when such non-traded good is produced in the informal segment of the economy, the degree of wage-inequality changes compared to the case of formal-sector production of the non-traded good. In particular, the wage-inequality rises more in case of import liberalization whereas its decline is less in case of an increase in the world price of agricultural exports. In other case the informal non-traded sector by itself is a source of deteriorating position of the unskilled workers.

The rest of the paper is organized as follows. In sector 2 we spell out the working of the model and examine the link between trade liberalization and wage-inequality. To highlight the role of non-traded good, we first spell out such a relationship with all goods being internationally traded. Then it is indicated how the results are modified when one of these sectors is organized non-traded sector. Section 3 discusses the implications of the informal non-traded sector for the effects of freer trade on the wage-inequality. Finally, in section 4 we provide some concluding remarks

A small open economy with a formal non-traded sector

Consider a small open economy producing four goods: agricultural export good (X) using unskilled labour (L) and sector-specific land (T); manufacturing exports (Z) combining domestic capital (K) and sector-specific skilled labour (S); manufacturing import-competing good (Y) combining unskilled labour and domestic capital; and a non-traded good (N) using only unskilled labour in fixed proportion. Both the import-competing and non-traded goods are produced in the formal sectors where unskilled labour is hired at a contractual nominal wage, \bar{w} . On the other hand, in conformity with the observed phenomenon in the LDCs, the agricultural sector is modelled as the informal sector where the unskilled labour gets a lower market-determined nominal wage, w .

All production is subject to constant returns to scale (CRS) and except for the

non-traded production there is diminishing returns to the variable factors in each sector. Given these assumptions, the zero-profit conditions in the four commodity markets can be written as :

$$P_x^* = a_{Lx}w + a_{Tx}R \quad (1)$$

$$P_y = (1+t)P_y^* = a_{Ly}\bar{w} + a_{Ky}r \quad (2)$$

$$P_z^* = a_{Sz}w_s + a_{Kz}r \quad (3)$$

$$P_N = a_{LN}\bar{w} \quad (4)$$

where R and r are the returns to land and domestic capital respectively; t is the rate of ad-valorem tariff on imports; and $P_j^*, j = X, Y, Z$ is the world price of the j -th traded good.

Flexibility of all factor prices (except the formal sector unskilled wage), on the other hand, guarantees full employment of the four factors of production:

$$\bar{T} = a_{Tx}X \quad (5)$$

$$\bar{S} = a_{Sz}Z \quad (6)$$

$$\bar{K} = a_{Ky}Y + a_{Kz}Z \quad (7)$$

$$\bar{L} = a_{Ly}Y + a_{Lx}X + a_{LN}N \quad (8)$$

Any informal market for the skilled workers is assumed away and we allow skill wage, w_s , to vary to ensure full employment of skilled workers. The unskilled workers who do not find jobs in the formal sectors move to the informal agricultural sector and flexibility of nominal wage ensures that all of them get absorbed there. Thus even with two distinct wages, unskilled labour is fully employed in our model. In this regard we deviate from the standard Harris-Todaro type assumption and instead follow the available empirical evidences cited in Agenor (1996), Agenor and Montiel (1996) and Mazumdar (1993) that low-skilled workers cannot afford to remain unemployed.

Finally, the market for non-traded good must clear domestically. With the simplifying assumption that α -proportion of the total urban income is spent on non-tradeable and that the rural population does not have access to the urban non-traded output, this market-clearing condition can be stated as :

$$P_N N = \alpha [(a_{Ly}Y + a_{LN}N)\bar{w} + w_s \bar{S} + r \bar{K}] \quad (9)$$

Note that once the non-traded market is cleared the overall trade is balanced.

The above set of nine equations solve for the nine variables – four factor prices, (w_s, w, r, R) , four output levels, (X, Z, Y, N) , and the price of the non-traded good, P_N . Of course, there are the input choices, except the labour-nontradeables coefficient (a_{LN}), which are determined once we know the factor prices :

$$a_{ij} = a_{ij}(w_s, w, r, R) \quad (10)$$

The actual process of determination of equilibrium is as follows. Given the world price of the import good, P_y^* , and the ad-valorem tariff rate, t , the zero-profit condition (2) determines the rate of return to capital, r , which in turn determines the skill-wage, w_s , from the zero-profit condition in the manufacturing export sector given world price, P_z^* . On the other hand, the price of the non-traded good is given by the labour cost, which is the product of fixed input coefficient and the contracted unskilled wage, independent of the demand for non-traded good.

Once the skill-wage and the rate of return to capital are known, total skilled labour force determines the manufacturing export production (see (6)) and this together with the total domestic capital stock gives us the production of the import-competing good (see eq. (7)). The non-traded output, on the other hand, is demand-determined given the equilibrium values of w_s, r and Y , as evident from the market-clearing condition (9). The rest of the variables, w, R and X can be solved using (1), (5), (8).

The important point to note is that the formal sectors form an independent subsystem of the economy. The output and prices of the factors used in production of Z , Y and N are all determined independent of the informal agricultural sector. But the wage rate, the return to land and the agricultural output level crucially depend on the equilibrium values in the formal sectors of the economy. This is exactly what we can expect. Since only those unskilled workers who are not employed in the formal import-competing and non-traded sectors at the higher contractual wage move to the informal agriculture, it is obvious that its production activities will be constrained by the outputs and hence by the demand for unskilled labour in the formal sectors (see eq. (8)). Herein comes the role of the non-traded good. Had all goods been traded, production of agricultural exports would not necessarily be constrained by the demand for non-traded good and the consequent demand for unskilled labour. Any excess demand would have been met through imports. Finally, given such an output level of the agricultural exports, informal sector wage and the return to the specific factor, land, must be so as to satisfy the zero-profit condition (1) and full employment condition for land (5).

Trade Liberalization and wage-inequality

In this set up trade liberalization implies combination of the following changes :

1. a tariff reduction : $\hat{t} < 0$;
2. an increase in the world price of agricultural exports : $\hat{P}_x^* > 0$;
3. an increase in the world price of manufacturing exports : $\hat{P}_z^* > 0$.

The increases in the world prices of exports for this small open economy may be due to the multilateral tariff reductions by the (large) trading partners and the consequent increase in their import demands. Our concern here is to examine how trade liberalization affects the wage-inequality captured through the wage-gap between skilled and unskilled workers. Since the unskilled labour gets either the contracted wage, \bar{w} in the formal sectors or a lower wage, w , in the informal agricultural sector, we define an average wage, ω , for our purpose :

$$\omega \equiv (1 - \lambda_{LX})\bar{w} + \lambda_{LX}w \quad (11)$$

where λ_{LX} is the share of agriculture in total employment of unskilled labour. Therefore, what we look at is the effect on e :

$$e \equiv \frac{\omega}{w_S} \quad (12)$$

An increase (decrease) in the value of e implies a declining (rising) wage-gap. However, as evident from (11), given this measure of wage-inequality, not only changes in wage rates but also those in employment shares in the formal and informal sectors are important. In particular, if good-N is produced in the formal sector, the change in wage inequality can be decomposed as :

$$\begin{aligned} \bar{e} &= \bar{\omega} - \hat{w}_S \\ &= \left[\frac{1}{\omega} (\bar{w} - w) (d\lambda_{LY} + d\lambda_{LN}) + d\hat{w} \right] - \hat{\omega}_S \end{aligned} \quad (13)$$

$$\text{where } \delta = \frac{w\lambda_{LX}}{(1 - \lambda_{LX})\bar{w} + \lambda_{LX}w}$$

But when good-N is produced in the informal sector, the decomposition changes to,

$$\hat{e} = \left[\frac{1}{w'} (\bar{w} - w) d\lambda_{LY} + d'\hat{w} \right] - \hat{\omega}_S \quad (14)$$

$$\text{where } \delta' = \frac{w(1 - \lambda_{LY})}{\lambda_{LY}\bar{w} + (1 - \lambda_{LY})w}$$

Given such measures of wage-inequality, we now proceed to examine the implications of trade liberalization. Though (multilateral) trade liberalization should imply the above mentioned price changes simultaneously, to fix ideas we consider the effects of each of these changes one at a time.

However, to highlight the role of the non-trade good, let us begin with the trade and factor-price relationship when all goods are traded. Thus, with good-N being traded as well in this exercise, the model specified above boils down to standard 4x4 HO model. Note that eq.(9) is now redundant because once the four factor prices are determined from competitive price equations, full employment conditions determine the output levels independent of domestic demand for the goods. However, with only unskilled labour being used to produce good-N, we must assume this sector as informal sector so that producers can hire unskilled labour at market determined flexible money wage. With such modification, effect of trade liberalization on factor prices and wage inequality is summarised in Table-1. The proofs are simple and are avoided here.

The interesting point to observe is that despite an increase in world price of agricultural good, the unskilled wage being tied down by the world price of good-N, unskilled workers do not gain. Skilled workers gain neither, leaving the wage-inequality (as well as the standard measure of wage-gap indicated in column 6) unchanged. On the other hand, if good-N imported, fall in its price reduces the wage-inequality.

Table 1

Effect of Trade Liberalization on
Factor Price when all goods are Traded

Initial Shock	\hat{w}_s	\hat{w}	\hat{r}	\hat{R}	$\widehat{w/w_s}$	\hat{e}
$\hat{P}_Y < 0$	+	0	-	0	-	-
$\hat{P}_x^* < 0$	0	0	0	+	0	0
$\hat{P}_Z^* < 0$	+	0	0	0	-	-
$\hat{P}_N > 0, < 0$	0	\pm	0	\pm	\pm	\pm

With these effects at hand, we now refer back to our model specified earlier with good-N being not traded, and reexamine the relationship between trade liberalization and wage-inequality. To begin with we assume non-traded good is produced in the formal sector of the economy. Later we shall explore the other case.

Import Liberalization : $\hat{t} < 0$

The immediate impact of a tariff cut is to reduce the rate of return to capital and consequently to raise the skilled wage as evident from the zero-profit conditions (2)

and (3) :

$$\hat{r} = \frac{\theta_i}{\theta_{KY}} \hat{t} < 0 \quad (15)$$

$$\hat{w}_s = -\frac{\theta_i \theta_{KZ}}{\theta_{SZ} \theta_{KY}} \hat{t} > 0 \quad (16)$$

where $\theta_i \equiv \frac{t}{1+t}$ = share of tariff revenue in domestic price of imports, $\theta_{SZ} \equiv \frac{w_s a_{SZ}}{P_Z^*}$ = share of skilled labour in total cost of Z-production and $\theta_{Kj} \equiv \frac{r a_{Kj}}{P_j}$ = share of capital in the total cost of producing the j-th good. On the other hand, using (1), (5) and (8) the change in the informal unskilled wage can be obtained as (see appendix):

$$\frac{\lambda_{LX} \alpha}{\theta_{TX}} \hat{w} = \lambda_{LY} (\sigma_y \theta_i \hat{t} + \hat{Y}) + \lambda_{LN} \hat{N} \quad (17)$$

where α_j is the elasticity factor substitution in the j-th production.

The left hand side in (17) measures the change in labour demand in the informal sector due to the input substitution effect. But this is an induced effect of the change in unskilled wage. If the demand for the unskilled labour in the rest of the economy, as measured by the right hand side of (17), does not change there is no reason why the unskilled wage should change. Accordingly, with P_X^* not changing in this instance, the factor price ratio in agriculture, w/R , and hence the unskilled labour-land ratio will remain unchanged. Therefore, there would be no change in total demand for unskilled labour and consequently no change in the informal unskilled wage implying a widening wage-gap. Whether this be the case or not depends on how the productions of import-competing and non-traded goods are changing and on the input substitution effect in the import-competing sector. The first term on the right hand side, $\lambda_{LY} \sigma_y \theta_i \hat{t}$, captures the fall in labour demand due to substitution of relatively cheaper capital for labour following import liberalization (see eq.(15)).

There is also a fall in demand for unskilled labour on account of the contraction of the import-competing sector measured by the second term, $\lambda_{LY} \hat{Y}$. The import-competing sector contracts on two accounts. First of all, an expansion of the manufacturing export production through domestic capital from the import-competing sector

$$\hat{Z} = -\hat{a}_{zx} \quad [\text{from (6)}]$$

$$= -\frac{\theta_l \theta_{KZ} \sigma_z}{\theta_{KY} \theta_{SZ}} \hat{t} > 0 \quad (18)$$

Second, with the wage-rental ratio, \bar{w}/r , going down, more capital-intensive technique is employed to produce the import-competing good which lowers output for any given allocation of the capital stock. The exact expression combining these two effects is given as (see appendix) :

$$\hat{Y} = A \theta_l \hat{t} < 0 \quad (19)$$

where,

$$A \equiv \sigma_Y \frac{\theta_{LY}}{\theta_{KY}} + \frac{\lambda_{KZ} \sigma_Z}{\lambda_{KY} \theta_{KY} \theta_{SZ}} \quad (19a)$$

Therefore informal sector unskilled wage unambiguously falls if the non-traded sector contracts as well thereby adding to the pool of released unskilled labour. And this is exactly what happens to be the case. Hence,

PROPOSITION 1:

In the above set up with a formal non-traded sector, import liberalization ($\hat{t} < 0$) unambiguously raises wage-inequality.

[Proof]

From (13) it is evident that since $d\lambda_{LY} < 0$ in this case and $\bar{w} > w^*$, given (17), (19) and $\lambda_{LN} = a_{LN}N$, wage-inequality rises ($\hat{e} < 0$) if the non-traded sector contracts, i.e., if $\hat{N} < 0$. Rewrite (9) as

$$\alpha[(1+t)P_Y^*Y + P_Z^*Z] = (1-\alpha)P_NN \quad (9a)$$

Expressing (9a) in percentage change from we get,

$$\gamma(\hat{Y} + \theta_l \hat{t}) + (1-\gamma)\hat{Z} = \hat{N} \quad (21)$$

where $\gamma \equiv \frac{\alpha(1+t)P_Y^*Y}{(1-\alpha)P_NN}$, $(1-g) \equiv \frac{\alpha P_Z^*Z}{(1-\alpha)P_NN}$. Substitution of values from (18) and (19) in (21) yields,

$$\hat{N} = q_l \left[\frac{g(q_{LY}s_Y + q_{KY})}{q_{KY}} + \frac{\{g l_{KZ} - (1-g)q_{KZ}l_{KY}\}s_Z}{l_{KY}q_{KY}q_{SZ}} \right] \hat{t} \quad (22)$$

Consider the numerator of the second term on the right hand side of (22),

$$\sigma_Z[\gamma\lambda_{KZ} - (1-\gamma)\theta_{KZ}\lambda_{KY}] = \frac{\alpha\sigma_Z a_{KZ} YZ}{\bar{K}(1-\alpha)P_N N} [P_Y - r a_{KY}] > 0 \text{ by (2)}$$

Therefore, the term in the parenthesis is positive and accordingly $\hat{N} < 0$ given $\hat{t} < 0$. Hence the claim.

Increase in the world price of agricultural exports ($\hat{P}_X^ > 0$)*

How does multilateral trade liberalization leading to an increase in the world price of the agricultural export for this small open economy affect wage-inequality there? First of all, note that with the unchanged world price of imports and the tariff rate, the rate of return to capital and consequently skill wage do not change. Accordingly there will be no input substitution effect through which the manufacturing export production (Z) and import-competing production (Y) can change. On the other hand, with price of the non-traded good dragged down by the contractual wage payments, non-traded output also cannot change since the urban income and hence the demand for non-traded good are unchanged. This is obvious because the formal sectors in this set up constitute the independent subsystem and accordingly any parametric changes in the informal agricultural sector will leave these sectors undisturbed. Consequently the agricultural export sector can expand following the increase in the world price only by using labour less intensively and land more intensively. But given fixed endowment of land specific to this sector this is not possible. Therefore, the only effect will be proportional increases in the unskilled wage and the return to land with no real effect. Hence,

PROPOSITION 2:

In the above set up with a formal non-traded sector, an increase in the world price of agricultural good unambiguously reduces wage-inequality.

[Proof]

Since $d\lambda_{LY} = 0 = d\lambda_{LN} = \hat{w}_s$, from (13),

$$\hat{e} = \frac{1}{\omega}(\bar{w} - \omega) + \delta\hat{w} \quad (13a)$$

Now from (1), (5) and (8),

$$\hat{L} = 0 = \lambda_{LX}(\hat{X} + \hat{a}_{LX}) + \lambda_{LY}(\hat{Y} + \hat{a}_{LY}) + \lambda_{LN}\hat{N}$$

But $\hat{Y} = \hat{N} = \hat{a}_{LY} = 0$. Hence, using (5) and the definition of elasticity of factor

substitution σ_X we get,

$$\lambda_{LX}\sigma_X(\hat{w}-\hat{R})=0$$

Finally from (1), $\hat{P}_X^* = \theta_{LX}\hat{w} + \theta_{TX}\hat{R}$. Therefore,

$$\hat{w} = \hat{R} = \hat{P}_X^* > 0 \quad (23)$$

Substitution of (23) in (13a) shows that $\hat{e} > 0$. Hence the claim.

However, as we show later, if the non-traded good is produced in the informal sector, changes in the unskilled wage will affect the price of the non-traded good as well which in turn affects the non-traded production even if the urban income remains constant. Accordingly, the unskilled wage will be affected further.

An increase in the world price of manufacturing exports $\hat{P}_Z^ > 0$*

An increase in the price of the manufacturing exports, $\hat{P}_Z^* > 0$, unlike the previous case will have the real effects. The immediate impact will be an increase in the skill wage and with the rate of return to capital held fixed by the given world price of importable and the ad-valorem tariff rate, such increase will be more than proportionate:

$$\hat{w}_s = \frac{1}{\theta_{SZ}} \hat{P}_Z^* > 0 \quad (24)$$

Consequently input substitution effect will raise production of manufacturing exports:

$$\hat{Z} = -\hat{a}_Z = \frac{\theta_{KZ}}{\theta_{SZ}} \sigma_Z \hat{P}_Z^* > 0 \quad (25)$$

This causes output of the import-competing good to fall since some capital is withdrawn to support the additional production of the Z-good:

$$\hat{Y} = -\frac{\sigma_Z \lambda_{KZ}}{\theta_{SZ} \lambda_{KY}} \hat{P}_Z^* < 0 \quad (26)$$

But the change in urban income and consequently the demand for non-traded good are ambiguous:

$$\hat{N} = -\frac{\sigma_Z}{\theta_{SZ}} \left[-\gamma \frac{\lambda_{KZ}}{\lambda_{KY}} + (1-\gamma)\theta_{KZ} \right] \hat{P}_Z^* + (1-\gamma)\hat{P}_Z^* \quad (27)$$

The term in the parenthesis is negative for similar reason which ensured positivity of \hat{N} in (22). Therefore, in this case \hat{N} can be of either sign. If non-traded production falls, some unskilled labour will be released from this sector as well along with that from the import-competing sector and accordingly the unskilled wage must fall to absorb them in the informal agriculture. But if non-traded production increases, not significantly though, some of the released unskilled labour will be absorbed in the non-traded sector thereby necessitating much smaller wage fall in the informal agricultural sector. In either case, the wage-gap widens. It is only when non-traded production increases significantly, requiring more unskilled labour than are released by the contracting import-competing sector, the unskilled wage will go up and wage-gap may decline consequent upon such (net) excess demand for unskilled labour in the formal sector as a whole. Therefore,

PROPOSITION 3:

For a small open economy with a formal non-traded sector, an increase in the world price of its manufacturing exports may lower the wage-inequality. A necessary condition for this is that the non-traded sector must expand along with the manufacturing export sector.

[Proof]

Follows from the above discussion. \square

We are now in a position to indicate how production of a non-traded good alters the relationship between trade liberalization and wage-inequality. Table 2 shows this where the second column reproduces column 7 of Table 1. Rest of the columns in Table 2 summarises results derived in proposition 1-3.

Table 2

Trade and Wage Inequality :

Implications of Non-Traded Good

Initial Shock	Good-N is traded	Good-N is non-traded (formal sector)
$\hat{P}_Z^* > 0$	$\hat{e} < 0$	a. $\hat{e} < 0$ and magnified if $\hat{N} < 0$ b. $\hat{e} \begin{matrix} \geq \\ < \end{matrix} 0$, If $\hat{N} > 0$
$\hat{P}_Y < 0$	$\hat{e} < 0$	$\hat{e} < 0$ and magnified
$\hat{P}_X^o > 0$	$\hat{e} = 0$	$\hat{e} > 0$

Whereas import liberalization by the domestic country has similar adverse effect on wage-inequality, except for the degree of such inequality, in other cases production of non-traded good significantly alters the relationship between trade and wage-inequality.

The role of an 'informal' non-traded sector

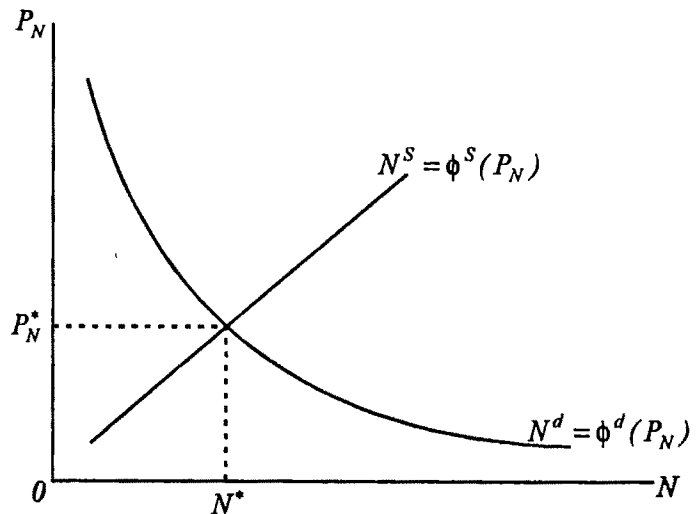
So far we have considered a formal non-traded sector. One implication of this assumption is that the non-traded price is held fixed by the contracted unskilled wage. But in case of non-traded good being produced in the informal sector where unskilled labour is paid the market-determined (flexible) money wage, non-traded output is no longer demand-determined. Similarly, the non-traded price is not just cost-determined.

With the informal sector production of the non-traded good, the zero-profit condition (4) now must be rewritten as :

$$P_N = a_{LN}w \quad (4a)$$

The price and outputs in the formal sectors, Y and Z, can still be determined independent of the informal sectors, N and X. The rest of the variables, P_N, w, R, N and X, are determined in the following way. For any given P^* , (4a) determines the unskilled wage, w , which in turn determines the return to land, R , from the zero-profit condition (1). Given these factor prices along with the consequent input choices, the output levels of the agricultural exports and non-traded good, X and N, are determined from (5) and (8) respectively. This describes a supply relationship for the non-traded good: $N^S = \phi(P_N)$. An increase in P_N raises w and lowers R ; the consequent increase in intensity of land use lowers the agricultural output (X) which along with the less intensive use of unskilled labour increases. We, therefore, have a positive association between P_N and N^S . On the other hand, (9a) gives us a rectangular hyperbola demand curve for the non-traded good. Therefore, the equilibrium price and output of non-traded good, (P_N^*, N^*) , are determined by the equality of supply and demand relationships as illustrated in Figure 1.

Figure 1
Equilibrium in
the non-traded
informal sector.



This interplay of demand for and supply of non-traded good in determining its price and output levels has far reaching implications on the wage-gap between skilled and unskilled labour. Given (4a), i.e., $\hat{P}_N = \hat{w}$, it is immediate that whether the wage-gap widens or declines following trade liberalization depends crucially on the movement of the non-traded price. In the previous case of the formal non-traded sector it was only the demand-determined non-traded output which was crucial. But now with the price of non-traded good no longer dragged down by the contracted unskilled money wage, supply of non-traded good is no less important in determining the movement in unskilled wage.

Consider first the case of import liberalization, $\hat{t} < 0$. At the initial P_N , this unambiguously lowers the urban income and consequently the demand for non-traded good as indicated by (22). That is, the demand curve in Figure 1 shifts to the left. The consequent excess supply puts a downward pressure on P_N . How is the supply of non-traded good affected? At the initial P_N and hence w and X , a fall in the production of the import-competing good (see eq. (19)) as well as less intensive use of unskilled labour in such production due to fall in r/w (see eq. (15)) relaxes the (net) labour constraint for the non-traded sector thereby raising its production. Thus, the supply curve in Figure 1 shifts to the right reinforcing the excess supply consequent upon the demand fall and the price of the non-traded good falls unambiguously. Therefore,

PROPOSITION 4 :

With an informal non-traded sector, import liberalization by a small open economy increases wage-inequality more than with a formal non-traded sector.

[Proof]

From (4a) and (17) we get the supply-side relationship between \hat{P}_N and \hat{N} as,

$$\frac{\lambda_{LX}\sigma_X}{\theta_{TX}}\hat{P}_N - \lambda_{LN}\hat{N} = \lambda_{LY}(\sigma_Y + A)\theta_t\hat{t} \quad (28)$$

This together with the demand-side relationship from (9a),

$$\hat{P}_N + \hat{N} = \left[\gamma(A+I) - (1-\gamma)\frac{\sigma_Z\theta_{KZ}}{\theta_{KY}\theta_{SZ}} \right] \theta_t\hat{t} \quad (29)$$

solve for the equilibrium change in the price of the non-traded good:

$$\hat{P}_N = \frac{1}{D} \left[l_{LY}(s_Y + A) + l_{LN} \{ g(A + 1) - (1 - g) \frac{s_Z q_{KZ}}{q_{KY} q_{SZ}} \} \right] q_i \hat{t} < 0 \quad (30)$$

where,

$$\Delta \equiv \frac{\lambda_{LX} \sigma_X}{\theta_{TX}} + \lambda_{LN} > 0 \quad (31)$$

The second term in the parenthesis on the right hand side of (30) measures the demand effect on P_N and this is positive by (22). The first term captures the supply effect which is also positive in sign. Therefore, price of the non-traded good unambiguously falls with the reduction in the tariff rate. Accordingly the unskilled wage falls and with the skill wage increasing and employment in the formal import-competing sector falling, wage-inequality grows (see eq. (14)). This completes the proof of the first part.

When the non-traded good is produced in the formal sector there would be no supply effect since the non-traded price is dragged down by the contracted unskilled wage. That is, the fall in unskilled wage and the consequent widening of the wage-gap are caused only by the fall in non-traded demand through fall in urban income. But in case of informal sector production of the non-traded good, we have a supply effect too which reinforces fall in unskilled wage and hence magnifies the widening wage-gap.

Hence the claim. \square

The case of an increase in the world price of agricultural exports, $\hat{P}_X^* > 0$, can similarly be worked out. As explained earlier in section 2.2.2, at the initial P_N , there will be no change in the demand for non-traded since the urban income is determined independent of the informal agricultural sector. The proportional increase in the unskilled wage consequent upon the increase in \hat{P}_X^* , as explained earlier, will however trigger a supply effect. Given (4a), the non-traded price will increase proportionately, i.e., the supply curve in Figure 1 will shift up. The consequent contraction of the non-traded sector will release some unskilled labour which in turn will dampen the initial (proportional) increase in unskilled wage. In other words, due to the supply-effect the decline in the wage-gap will now be not as large as it is in case when non-traded good produced in the formal sector. Note that, the increase in the price of agricultural export good will now have a real effect which in fact makes the increase in the unskilled wage less than proportional.

On the other hand, when the world price of the manufacturing exports increases, $\hat{P}_Z^* > 0$, the demand effect on the non-traded price is given by (27). Since the sign of

\hat{N} in (27) is ambiguous, P_N may go in either direction. On the other hand, supply-effect depresses the non-traded price. At the initial P_N and hence at the initial w and X , unskilled labour released from the contracting import-competing sector (see (26)) relaxed the (net) labour constraint for the non-traded sector and thereby raises its supply. The net change in non-traded price is, therefore, ambiguous. But what is to be noted that the additional supply effect lowers the unskilled wage. Thus, if in case of formal sector production the wage-inequality increased (declined), it will now be magnified (dampened).

In sum, an informal sector does have a perceptible influence on the effect of trade liberalization on wage-inequality. Though the direction of changes in wage-inequality is not affected much, the degree of such inequality is quite different depending upon whether the non-traded good is produced in the formal or informal sector. In any case, however, informal sector production of the non-traded good affects the unskilled workers adversely.

Conclusion

In this paper we have examined the role of a non-traded sector in the context of effect of trade liberalization on wage-inequality in a typical developing economy. In terms of a simple four sector general equilibrium model consistent with diversified trade patterns and production structures of many developing countries, we find that whereas the import liberalization indeed causes the wage-gap between skilled and unskilled labour and hence wage-inequality to increase, improvement in the terms of trade through the increase in the world price of exports depend upon the nature of the export good. For an increase in the price of the manufacturing exports that does not use unskilled labour, the wage-gap may in fact decline through a sufficiently large increase in the demand for and output of the non-traded good. Herein lies the role of the non-traded good. On the other hand, if the price increase is for the agricultural export good using unskilled labour, the wage-gap unambiguously falls. Moreover, depending on whether the non-traded good is produced in the formal or informal sector, there will be real effects if such a price increase.

The informality of the non-traded sector by itself makes quite significant differences. It either magnifies wage-inequality (as in case of import liberalization) or dampens the improvement in the relative position of the unskilled labour (as in case of increase in world price of agricultural exports). In either cases, it works against the interest of the unskilled labour. Since the informal sectors are a major source of employment for unskilled workers in the developing economies, these results have far reaching implications for policy-making in these countries.

Our results do not change qualitatively if we allow capital mobility across the non-traded and formal traded sectors. Suppose, the non-traded good uses domestic capital along with unskilled labour (see (2)), the effect of an increase in the price of agricultural exports, for example, will be identical as in section 2.1.2 and section 3. What all we need to do is to reinterpret P_N in eqs. (4) and (4a) as the price of non-traded good net of capital cost. In case of import liberalization, on the other hand, the fall in rate of return to capital (see (15)) will reduce P_N and accordingly we have a (positive) supply effect even with formal sector production of the non-traded good which, however, only arrests to some extent the increasing wage-inequality.

APPENDIX

I. The change in the unskilled wage

Substitution of value of X from (5) in (8) yields,

$$\frac{a_{LX}}{a_{TX}}\bar{T} + a_{LY}Y + a_{LN}N = \bar{L} \quad \text{A.1}$$

Expressing (A.1) in percentage change from we obtain,

$$\lambda_{LX}(\hat{a}_{LX} - \hat{a}_{TX}) + \lambda_{LY}(\hat{a}_{LY} + \hat{Y}) + \lambda_{LN}\hat{N} = 0 \quad \text{A.2}$$

By definition,

$$\sigma_X = \frac{\hat{a}_{LX} - \hat{a}_{TX}}{\hat{w} - \hat{R}} \quad \text{A.3}$$

But from (1),

$$\hat{P}_X^* = 0 = \theta_{LX}\hat{w} + \theta_{TX}\hat{R}$$

i.e., $\hat{R} = -\frac{\theta_{LX}}{\theta_{TX}}\hat{w}$ A.4

Combining (A.2), (A.3) and (A.4) and rearranging terms we get eq. (17) in the text.

II. The change in the output of import-competing good.

From (6) and (7),

$$\lambda_{KY}(\hat{a}_{KY} + \hat{Y}) + \lambda_{KZ}(\hat{a}_{KZ} - \hat{a}_{SZ}) = 0 \quad \text{A.5}$$

By the least-cost input combination rule,

$$\theta_{KY}\hat{a}_{KY} + \theta_{LY}\hat{a}_{LY} = 0 \quad \text{A.6}$$

whereas by definition, given $\hat{w} = 0$,

$$-\hat{r}\sigma_Y = \hat{a}_{KY} - \hat{a}_{LY} \quad \text{A.7}$$

Combining (A.6) and (A.7) we get,

$$\begin{aligned} \hat{a}_{KY} &= \frac{\theta_{KY}}{\theta_{LY}} \hat{a}_{LY} - \hat{r}\sigma_Y \\ &= -\frac{\theta_I \theta_{LY}}{\theta_{KY}} \hat{t} \quad [\text{using (13)}] \end{aligned} \quad \text{A.8}$$

On the other hand,

$$\begin{aligned} (\hat{a}_{KZ} - \hat{a}_{SZ}) &= \sigma_Z(\hat{r} - \hat{w}_S) \\ &= -\sigma_Z \left(1 + \frac{\theta_{KZ}}{\theta_{SZ}} \right) \frac{\theta_I}{\theta_{KY}} \hat{t} \\ &= -\frac{\sigma_Z \theta_I}{\theta_{SZ} \theta_{KY}} \hat{t} \end{aligned} \quad \text{A.9}$$

Substitution of (A.8) and (A.9) in (A.5) yields,

$$\hat{\gamma} = \left[\frac{\sigma_Y \theta_{LY}}{\theta_{KY}} + \frac{\sigma_Z \lambda_{KZ}}{\lambda_{KY} \theta_{SZ} \theta_{KY}} \right] \theta_I \hat{t} \quad \text{A.10}$$

which is eq. (19) in the text.

References

- Agenor, P.R. (1996) : The labour market and economic adjustment, *IMF Staff Paper* 32, 261-335.
- Berman, E., J. Bound and Z. Griliches (1994) : Changes in the demand for skilled labour within U. S. manufacturing industries, *Quarterly Journal of Economics*, 109:367-397.
- Beyer, H., Rojas, P., and R. Vergara (1999) : Trade liberalization and wage inequality, *Journal of Development Economics*, 59:103-123.
- Bhagwati, J.N. (1995) : Trade and wages : A malign relationship?, *Unpublished manuscript*, Columbia University.

- Caves, R.E., J.A. Frankel and R.W. Jones (1996) : World Trade and Payments : An Introduction, *Seventh Edition, Harper Collins*.
- Cole, W.E. and R.D. Sanders (1985) : Internal migration and urban employment in the third world, *American Economic Review*, 75:481-94.
- Davis, D. (1998) : Does European unemployment prop up American wages? National labour markets and global trade, *American Economic Review*.
- Feenstra, R., and G. Hanson (1995) : Foreign investment, outsourcing and relative wages, In : R.Feenstra, G. Grossman and D.Irwin, eds., *Political Economy of Trade Policies, Essays in Honour of J.N. Bhagwati*, MIT Press.
- Fields, G. (1990) : Labour market modeling and the urban informal sector : Theory and evidence. In : Turnham, D., (ed.), *The Informal Sector and Evidence Rervisited*, OECD, Paris.
- Jones, R.W., H. Beladi and S. Marjit (1990) : Three faces of factor intensities, *Journal of International Economics*.
- Jones, R.W. and S.L. Engerman (1996) : Trade, technology and wages: A tale of two countries, *American Economic Review*, 86:35-40.
- Khan, A.R. (1998) : The impact of globalization in South Asia. A.S. Bhalla, ed., *Globalization, Growth and Marginalization*, Macmillan.
- Khan, A.R. (1998b) : Growth and poverty in East and South-East Asia in the Era of Globalization. In : A.S. Bhalla, (ed.), *Globalization, Growth and Marginalization*, Macmillan.
- Krugman, P. (2000) : Technology, trade and factor prices, *Journal of International Economics*, 50:51-71.
- Leamer, E. (1995) : A trade economist's view of US wages and globalization. In : Collins, ed., *Imports, Exports and American worker*, Washington D.C.
- Marjit, S. (1997) : Terms of trade and wage-gap in the developing countries, *mimeo*, Centre for Studies in Social Sciences, Calcutta.
- Marjit, S., and R. Acharyya (2000) : Trade and wage-inequality in developing nations : A simple general equilibrium approach, *mineo*, Centre for Studies in Social Sciences, Calcutta.
- Mazumdar, D. (1983) : Segmented labour markets in LDCs, *American Economic Review*, 73:254-59.
- Mazumdar, D. (1993) : Labour markets and adjustment in open Asian economics : The Republic of Korea and Malaysia, *World Bank Economic Review*, 7:349-80.
- Meller, P. (1998) : Trade and employment in Latin America. In : O. Memedovic et.al.,

- eds., *Globalization of Labour Markets : Challenges, Adjustments and Policy Response in the European Union and Less Developed Countries*, *Kluwer Academic Publishers*.
- Pedersen, K. (1998) : Comment on 'Trade and employment in Latin America. In O. Memedovic et.al., eds., *Globalization of Labour Markets : Challenges, Adjustments and Policy Response in the European Union and Less Developed Countries*, *Kluwer Academic Publishers*.
- Rao, M. (1999) : Openness, poverty and inequality, *Background Papers : Human Development Report*.
- Robbins, D. (1994a) : Malaysian wage structure and its causes, *Harvard Institute for International Development*.
- Robbins, D. (1994b) : Philippine wage and employment structure, *Harvard Institute for International Development*.
- Robbins, D. (1995a) : Earnings dispersion in Chile after trade liberalization, *Harvard Institute for International Development*.
- Robbins, D. (1995b) : Trade, trade liberalization and inequality in Latin America and East Asia : Synthesis of seven country studies, *Harvard Institute of International Development*.
- Robbins, D. (1996a) : Stolper-Samuelson lost in the topics - Trade liberalization and wages in Columbia, *Harvard Institute of International Development*.
- Robbins, D. (1996b) : HOS hits facts : Facts win - Evidence on trade and wages in developing world, *Harvard Institute of International Development*.
- Robbins, D., and T. Zveglic (1995) : Skill-bias in recent Taiwanese growth, *Harvard Institute of International Development*.
- Tendulkar, S., Sundaraam, D.K. and L.R.Jain (1996) : Macroeconomic Policies and Poverty in India 1996-67 to 1993-94, *Manuscript, ILO, New Delhi*.
- Wood, A. (1997) : Openness and wage inequality in developing countries : The Latin American challenge to East Asian conventional wisdom, *World Bank Research Observer*, January.

Foreign Investment, Economic Reforms And the Size of the Domestic Market

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Abstract

In a demand constrained economy with unemployment, an increase in foreign investment increases or decreases domestic employment and output according as the size of the domestic market is small or large. Thus, for economies with large domestic markets, inflow of foreign capital should be accompanied with optimal adjustments in tariffs and the exchange rate. This simultaneous policy measures will reduce the cost of economic reforms and transition to a free market economy.

JEL Classification : O11, F21, F41.

Keywords : foreign investment, domestic employment.

1. Introduction

The present paper is concerned with the effects of direct foreign investment in a developing country. In recent years, most of these countries are going through phases of transition to free market economies and economic reforms leading to structural adjustments are being introduced to make this transition successful. Now, one of the main objectives of economic reforms is to attract foreign investment. It is generally believed that foreign investment would increase domestic employment and output and thus ease the process of transition. Therefore, in this paper, we look at foreign investment in the context of economic reforms. Consequently, we look at the effects of foreign investment on the domestic economy both in isolation and in conjunction with other liberalizing policies.

The recent literature on economic reforms is divided in one important respect. On the one hand, there are proponents of the 'big bang' approach who favour a quick and simultaneous introduction of all reform measures. On the other hand, there are those who argue that reforms should be gradual and well sequenced. Works falling in the first category include Lipton and Sachs (1990), Murphy et. al. (1992), Sachs (1993), Woo (1994) among others. An example in the second category is Dewatripont and Roland (1995).

In this paper we consider three specific trade related reforms, namely, reform leading to the opening up of the economy to foreign investment, reform leading to lowering of tariffs on imports and reform leading to the lowering of value of the domes-

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tic currency (i.e., devaluation). We come up with the conclusion that all these reforms will have to be simultaneous. As regards the speed of reforms, our analysis suggests that the speed of the last two reforms mentioned above would depend upon how fast foreign investment is coming in as a result of the first reform. More specifically, we show that with every inflow of foreign investment, the tariff rate and the exchange rate have to be optimally adjusted. In this sense, foreign investment captures the focal position in this paper.

The existing literature on foreign investment is indeed quite vast. It goes back to MacDougall (1960) and includes, among many other works, Brecher and Diaz Alejandro (1977) and Brecher and Findlay (1983). Apart from the fact that these papers are not specifically concerned with economic reforms, there are some other differences between the existing literature and the present work. Firstly, while in the existing literature the focus is on the long run equilibrium, in this paper we concentrate on the short run. Thus the existing literature considers equilibria where return to capital in the domestic market is equalized to the international return and foreign capital flows in and out of the domestic country to keep these returns equal. The present paper, on the other hand, concentrates on a short run transitory phase where domestic returns are still greater than international returns and it is worthwhile for foreign capital to flow into the country. However, all foreign capital does not flow in at once. We look at the behaviour of employment and output as foreign capital gradually starts flowing in.

Secondly, as a policy objective, our main focus is on employment. While there is some existing work on the effect of foreign investment on unemployment (e.g. Beladi and Marjit (1992)), these are concerned with classical unemployment resulting from real wage rigidity. In contrast, the present work considers demand constrained unemployment under flexible real wage but rigid money wage. Thirdly, in contrast with most of the existing literature we have imperfect competition in our model. The model that we develop below is related to Sarkar (1987) and Marjit and Sarkar (1995).

Apart from our conclusions about the sequencing of reforms, the paper comes up with another interesting result. It is shown that countries with small domestic markets always benefit from foreign investment in terms of employment and output. This benefit is accrued irrespective of whether other accompanying reform measures are adopted or not. Economies with large domestic markets, on the other hand, are shown to have an unambiguous contraction of employment and output in the short run as foreign capital starts coming in. More specifically, we show that economies with a large domestic markets can gain in terms of output and employment only if a lot of foreign capital comes in. For small and gradual capital inflows, the transition process becomes costly and to reduce this cost, other reform measures, like reduction of tariffs or devaluation, have to be adopted simultaneously. According to our analysis, therefore, the economy

with a large domestic market has a disadvantage so far as the transition process is concerned. This is in contrast with Basevi (1971) and Krugman (1984) where through economies of scale large domestic markets enhance the ability to export and are advantageous.

Casual empiricism seems to support our conclusions. Thus, one can argue that small countries like Hong Kong, Singapore or Taiwan have been much more successful with foreign investment than Latin American countries like Brazil or Mexico where the domestic market is large. In the case of China, the clue to the recent success story lies, in our opinion, in directing foreign investment to produce exports and not commodities for domestic consumption. In our model, this would always guarantee a positive effect of foreign investment. On the other hand, our analysis raises doubts about the short run positive effects of foreign investment in a country like India where foreign direct investment is primarily attracted by the large domestic market (see, e.g. the empirical studies in Gupta and Chawla (1995)).

The Paper is organized as follows. In section 2 we develop the basic model. In section 3 the main results of the paper are presented. Section 4 concludes the paper.

2. The Basic Model

We consider an economy where $(n + 1)$ goods are produced. Out of these, n goods are produced by foreign firms and will be referred to as quality goods. The i th quality good is represented by x_i . In addition, there is one traditional good produced by domestic firms. The traditional good is denoted by y . In this economy, the utility function of the representative consumer is

$$U = y^\alpha \prod_{i=1}^n x_i^{(1-\alpha)/n}, \quad 0 < \alpha < 1 \quad (2.1)$$

Utility function (2.1) implies that a fraction α of total income is spent on y ¹ and a fraction $(1 - \alpha)/n$ is spent on each quality good. Thus $(1 - \alpha)$ fraction of income is spent on all the quality goods taken together.

The domestic firms producing y are perfectly competitive. y is produced with labour L_y and a sector specific capital K_y , which is assumed to be given. The production function exhibits constant-returns-to-scale and diminishing returns. Profit maximization implies that L_y is determined at the point where the marginal productivity of labour is equal to the real wage in terms of good y . Throughout our analysis we assume that the money wage rate is given and at that given money wage some labour remains unemployed. Hence, as p_y , the price of good y , goes up, the real wage falls and employment and output goes up in the y -sector. In other words, the supply of y is an

¹ Though we do not incorporate saving-investment into the model explicitly, implicitly it may be done by assuming that a constant fraction of domestic absorption of y is saved and invested.

increasing function of p_y .

As for demand, there are two sources of demand for good y - domestic demand and exports. Domestic demand depends on domestic income which consists of wage income generated in the y and x sectors and profit income generated in the y -sector. Profit generated in the x sectors accrues to the foreign firms and, by assumption, is not spent domestically. It is repatriated abroad in the form of foreign exchange. This foreign exchange, in turn, is earned through exports. Demand for good y is given by the following equation

$$p_y y = \alpha [wL_x + p_y y] + p_y E(p_y) \quad (2.2)$$

Where w is the given money wage rate, L_x is the level of employment in the x sectors and $E(p_y)$ is the export demand function. The export demand function is falling in p_y and is assumed to be elastic² over the relevant range. Further, we assume that the exchange rate is fixed. For the moment, we normalize the exchange rate to be equal to one. Noting that the supply of y is a function of p_y , demand-supply balance in the y sector is represented by

$$y(p_y) = \frac{\alpha}{1-\alpha} \frac{w}{p_y} L_x + \frac{1}{1-\alpha} E(p_y) \quad (2.3)$$

Where the left hand side represents supply of y as a function of P_y and the right hand side represents demand. Note that for any arbitrarily given L_x , the right hand side is a decreasing function of p_y . Thus, for any arbitrary L_x , the demand and supply functions determine equilibrium in the y sector as shown in figure I. Also note that an increase in L_x shifts the demand function upwards and hence p_y goes up. Therefore we have

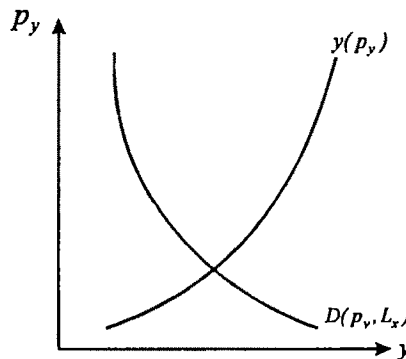


Figure I

² The assumption regarding elasticity of export demand guarantees stability of equilibrium.

³ For the arguments of this section, it is not necessary to assume a CES production function. We make use of the properties of a CES production function in the next section. See footnote 6 in this context.

$$p_y = f(L_x), \quad f' > 0 \quad (2.4)$$

which represents combinations of p_y and L_x which will clear the y market.

Let us now consider the x sectors. We assume that in each of the n quality good sectors there are m foreign firms engaged in Cournot competition. We further assume that each foreign firm has an identical CES production function³ of the form

$$x = [L^\rho + K^\rho]^{1/\rho} \quad (2.5)$$

where L and K are labour and capital employed and x is output. For simplicity, the capital invested by each firm is assumed to be the same. Given the stock of capital, the production function implies diminishing marginal productivity of labour and hence, given the money wage rate, rising marginal cost. Let x_y and x_y^* be the amounts sold by the j th firm of the i th quality good sector to the domestic and foreign markets respectively. Let $c(x_y + x_y^*)$ represent the total cost of labour as a function of output.

Let us assume for the moment that no import of quality goods is possible (say, due to total restriction on imports). Then domestic demand in the i th quality good sector is given by

$$x_i = \frac{(1-\alpha)}{n} \frac{I}{p_x} \quad (2.6)$$

where I is domestic income and p_x is the price. Since the quality goods enter symmetrically in the utility function and since the production functions of the quality goods are identical, in equilibrium, the price of each quality good must be the same. This common price is denoted by p_x .

In addition to domestic demand, a firm can sell any amount it wishes to in the international market at a fixed price p_x^{*4} . Thus the profit function of the j th multinational in the i th quality good sector is given by

$$\pi_y = \frac{(1-\alpha)}{n} \frac{I}{x_i} x_y + p_x^* x_y^* - c(x_y + x_y^*) \quad (2.7)$$

⁴ The export demand functions for the two sectors are not symmetric. For the x -goods the country is a price taker in the international market and can sell as much as it likes to at that price. For the y -good the country faces a downward sloping demand. Thus in the traditional good the country has some monopoly power, e.g. Indian tea or Malaysian rubber.

⁵ Each multinational, while maximizing its profits, assumes that it cannot affect the level of domestic income I . In other words, nxm is large. In fact, this is the only reason for having n sectors in quality good production.

There can be two different equilibrium situations. First, if domestic demand is not sufficiently large, the firm will be selling to both international and domestic markets. Second, if domestic demand is large, then the firm will find it profitable to sell only to the domestic market. In the first situation, marginal revenue (for the firm) cuts marginal cost below the international price line. In the second situation, the marginal cost curve cuts the marginal revenue curve on or above the international price line. These situations are shown in figures IIA and IIB.

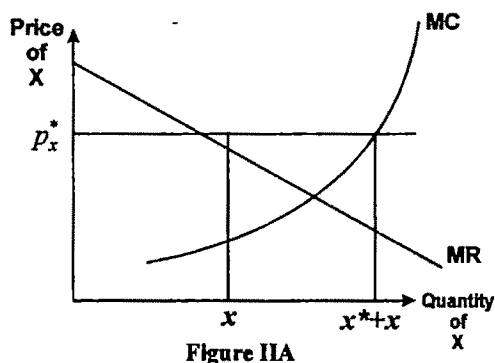


Figure IIA

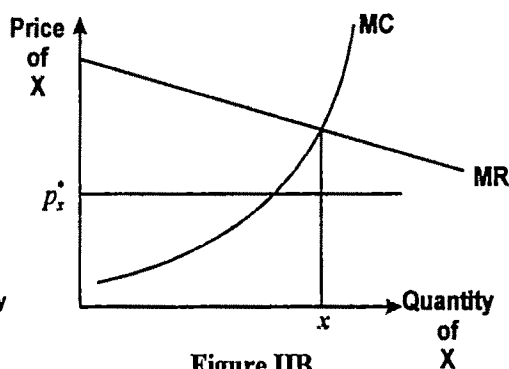


Figure IIB

It is clear that in our framework export of good x is residual. Thus if the domestic market is large, the firms have no incentive to export. This particular way of viewing exports as residual has some empirical support. For example, Riedel and Grawe (1984) show that in the 1970s, Indian exports have, to a large extent, been residual.

Let us first consider the case where both international and domestic markets are served (figure IIA). In this case, the first order conditions for profit maximization are given by⁵.

$$p_x^* = c'(x_y^* + x_y) \quad (2.8)$$

$$\frac{1-\alpha}{n} \frac{I}{x_i} - x_y \frac{1-\alpha}{n} \frac{I}{x_i^2} = c'(x_y^* + x_y) \quad (2.9)$$

Note that the marginal cost function is known from the production function and the money wage rate. Hence, given p_x^* , total output produced by the firm is determined from (2.8). Domestic price and quantity are determined from (2.6), (2.8) and (2.9) as

$$x_i = \frac{m-1}{m} \frac{1-\alpha}{n} \frac{I}{p_x^*}, \quad x_y = \frac{x_i}{m} \quad (2.10)$$

$$p_x = \frac{m}{m-1} p_x^* \quad (2.11)$$

In the second situation (figure IIB) where the firm sells only to the domestic market, price and quantity are given by

$$x_i = \frac{m-1}{m} \frac{1-\alpha}{n} \frac{I}{c'(x_y)}, \quad x_y = \frac{x_i}{m} \quad (2.12)$$

$$p_x = \frac{m}{m-1} c'(x_y) \quad (2.13)$$

Clearly, in both situations, price and output in the x sectors may be determined once we know the level of domestic income I . This has to be determined in a general equilibrium set up. In the case where the foreign firms serve both markets, it is particularly straight forward to determine the general equilibrium. In this case, L_x , the level of employment in the x sector, is determined independent of domestic income and domestic demand. Thus, we can go back to figure I and determine p_y , y and L_y , the last two variables being determined from the supply function of y . The determination of equilibrium in the second case where only the domestic market is served by the foreign firms, requires some more steps.

Consider the situation where the home market is so large that the foreign firms have no incentive to export. In the present context, the size of the home market is related to K_y , the stock of capital in the y sector. Start with a situation where domestic demand is small and both markets are served and then consider a rise in K_y . A rise in K_y shifts the supply curve of y to the right. This raises y and lowers p_y at unchanged L_x . But since demand for exports is assumed to be elastic, from (2.3) it follows that $p_y y$ must increase. Thus domestic income I goes up. This, in turn, shifts the marginal revenue curve of each foreign firm upwards. It is clear that for a sufficiently high K_y , the marginal revenue curve cuts the marginal cost curve above the p_x^* line. Thus if K_y is sufficiently high, the foreign firms will serve only the domestic market.

For the x sectors taken as a whole, we must have

$$p_x x = (1-\alpha) [p_y y + w L_x] \quad (2.14)$$

where $x = nx_i$. Using equation (2.2), (2.14) may be written as

$$p_x x - w L_x = p_y E(F_y) \quad (2.15)$$

The left hand side of (2.15) represents total profits of the foreign firms. The right hand side represents total export earning of the y sector. The two must be equal because foreign exchange, earned through exports of y , is used to pay for the profit repatriation of the foreign firms. In other words, equation (2.15) gives the balance of payments equilibrium.

How is the left hand side of (2.15) affected if L_x goes up in equilibrium? Writing

π_x for the left hand side of (2.15) and using (2.13) we have

$$\pi_x = nm \left[x_y \frac{m}{m-1} c'(x_y) - c(x_y) \right] \quad (2.16)$$

Thus we get

$$\frac{d\pi_x}{dL_x} = \left[\frac{m}{m-1} c''(x_y) + \frac{c'(x_y)}{m-1} \right] \frac{dx_y}{dL_x} > 0 \quad (2.17)$$

from the production function (2.5). Therefore, if L_x goes up in equilibrium, total profits in the x sectors must also increase. From (2.15) it then follows that if L_x goes up, the right hand side must go up too. This means that p_y must go down. Hence (2.15) gives us a relationship

$$L_x = \phi(p_y), \quad \phi' < 0. \quad (2.18)$$

Putting together (2.4) and (2.18) we determine the equilibrium values of p_y and L_x and hence of y and L_y as shown in figure III. This completes our description of equilibrium.

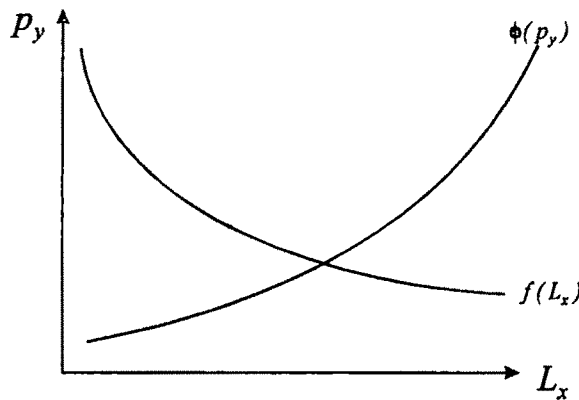


Figure III

3. Economic Reforms

In this section we present the main results of our paper. In particular, we look at the effects of three different trade related reforms on the economy. More specifically, we look at policies leading to (a) inflow of foreign capital, (b) reduction of tariffs, and (c) devaluation. While evaluating these policies we primarily look at their effects on domestic employment.

3.1 Inflow of Foreign Capital

It is straight forward to figure out the effect of an increase in K_x on domestic output and employment when the size of the domestic market is small and the foreign firms sell in both markets. For simplicity, we assume that the capital stock of each firm goes up by the same amount. This reduces marginal cost at each level of output, i.e.,

the marginal productivity of labour goes up at each level of output. Thus, given p_x^* , L_x goes up. This, in turn, leads to an increase in the demand for y and hence output and employment in the y sector also go up. Thus, when domestic demand is not very large, foreign investment unambiguously increases domestic output and employment.

Next, consider the case where the domestic market is large. First we demonstrate that, for any given L_x , an increase in K_x increases the profits of the foreign firms, i.e. the left hand side of (2.15). Since $\pi_x = p_x x - wL_x$ and wL_x is remaining constant (because L_x is given), we have to see what happens to $p_x x$ at unchanged L_x . From the production function (2.5)

$$\hat{x} = [L_x^\rho + K_x^\rho]^{-1} K_x^\rho \hat{K}_x \quad (3.1)$$

where a 'hat' on a variable denotes proportionate change. On the other hand, from (2.13) and (2.5)

$$\hat{p}_x = \hat{c}' = -(1-\rho)[L_x^\rho + K_x^\rho]^{-1} K_x^\rho \hat{K}_x \quad (3.2)$$

Thus combining (3.1) and (3.2) we get

$$\hat{p}_x + \hat{x} = \rho[L_x^\rho + K_x^\rho]^{-1} K_x^\rho \hat{K}_x > 0 \quad (3.3)$$

In other words, at unchanged L_x as K_x goes up, π_x also goes up^{6,7}. Going back to figure III, this means that the downward sloping curve shifts in and as a result both L_x and L_y go down in equilibrium. These results may be summarized in the following proposition:

Proposition 1. *Assuming total restriction on imports of the x goods, an increase in K_x unambiguously increases domestic employment if the domestic market is small and unambiguously increases domestic employment if the domestic market is large.*

It may be useful to discuss the intuition behind these results. When the domestic market is small, the foreign firms export a part of their output to the international market. In this case, L_x becomes autonomous of domestic income. An increase in K_x increases L_x and due to this autonomous increase in employment in the x sectors, the y sector also expands. If, on the other hand, the domestic market is large and the foreign firms have no incentive to export, an increase in K_x increases profits. Since these profits are repatriated, i.e. not spent on domestic goods, the leakage from the circular flow of income goes up and this leads to a fall in employment in both sectors and as well as in the output of y . This problem does not arise in the previous case because there the

⁶ If ρ goes to zero, the production function becomes Cobb-Douglas and profits remain unchanged as K_x goes up. In this case there is no incentive for foreign capital to come in. To guarantee that profits go up with an increase in K_x , we have assumed a CES production function.

⁷ To keep the notations clean we omit the subscripts i and j in the subsequent pages.

increase in profit is appropriated from the increased export market and does not increase the leakage from domestic income. On the other hand, the increase in wage income, due to the increase in exports, increases demand in the y sector leading to an expansion of that sector.

It is to be noted that we have used the terms 'large country' and 'small country' in this paper somewhat loosely. By a large country we have denoted one where the domestic market or domestic demand is large. Now, whether a country with a large domestic market would export good x would also depend on the level of foreign capital that has already flowed into the country. In particular, if the existing stock of foreign capital is high, then, in spite of a large domestic market, the country will export good x . What we want to focus on is the fact that given the same level of existing foreign capital, a country with a larger domestic market has a higher chance of experiencing a contraction of employment with a fresh inflow of foreign capital than a country with a smaller domestic market. Moreover, as foreign capital continues to flow in, the marginal cost curves in the x -sectors will keep on shifting to the right and eventually the country will start exporting good x . Once it starts exporting good x , employment will steadily rise with further inflows of foreign capital. Thus the relationship between foreign investment and domestic employment for a large country will have an inverted U-shape.

3.2 Optimal Tariff

So far we assumed that import of good x is totally restricted. This could be due to quantitative restrictions or due to high tariffs. Consider the case of tariffs. Let Tp_x^* denote the cost of importing x where p_x^* is the international price and $T \geq 1$ represents tariff. Let p_x^0 be the price of x when imports are totally restricted as assumed in sections 2 and 3.1 (i.e. p_x^0 is given by (2.13)). The underlying assumption of sections 2 and 3.1 was that $Tp_x^* \geq p_x^0$. Now suppose that the government wants to choose T such that employment and output are maximized. In this section, we are concerned with this optimal tariff.

Consider first the case where the domestic market is large. The actual price p_x prevailing in the market is given by

$$p_x = \min(p_x^0, Tp_x^*) \quad (3.4)$$

Define $\tilde{x}(p_x)$ as that level of output which satisfies $p_x = c'(\tilde{x})$. Also define $D_x(p_x)$ as domestic demand for x . From our analysis of section 2 it follows that for $p_x = p_x^0$, $[D_x(p_x) - \tilde{x}(p_x)]$ is negative. Assume that if $p_x = p_x^*$ (i.e. there is no tariff on x), $(D_x - \tilde{x})$ is positive, i.e. the country becomes a net importer of x .

Let us consider the behaviour of $(D_x - \tilde{x})$ with respect to changes in T and hence

p_x . For p_x less than but close to p_x^0 , a fall in p_x reduces \tilde{x} . On the other hand, as p_x falls, for a given L_x , π_x falls and hence the curve represented by (2.18) shifts out. As a result, L_x and p_y go up and so does D_x . Thus the absolute value of $(D_x - \tilde{x})$ goes down and approaches zero. Similarly, if p_x is greater than but close to p_x^* , a rise in p_x raises not only π_x , but also L_x and p_y . For, in this range, import is positive and so the foreign firms producing in the domestic economy are on their marginal cost curves. Hence, a rise in p_x raises L_x and therefore p_y . The rise in p_y reduces export earnings from y . A rise in π_x means that less foreign exchange is now available for imports. Thus from balance of payment equilibrium (i.e. $\pi_x + \text{value of imports} = p_y E(p_y)$), value of imports must fall. Since p_y goes up, this implies that $(D_x - \tilde{x})$ must fall. We represent $(D_x - \tilde{x})$ as a function of p_x in figure IV. By continuity, there exists a \tilde{p}_x such that at $p_x = \tilde{p}_x$, $(D_x - \tilde{x})$ is zero. We now demonstrate that the tariff rate corresponding to \tilde{p}_x is the optimal tariff.

First note that the actual level of domestic production is given by

$$x = \min(D_x, \tilde{x}) \quad (3.5)$$

Now if p_x falls below \tilde{p}_x , x falls and so L_x and L_y also go down⁸. On the other hand, If p_x rises above \tilde{p}_x , π_x goes up leading to reduction in D_x , L_x and L_y . Hence \tilde{p}_x maximizes employment and output.

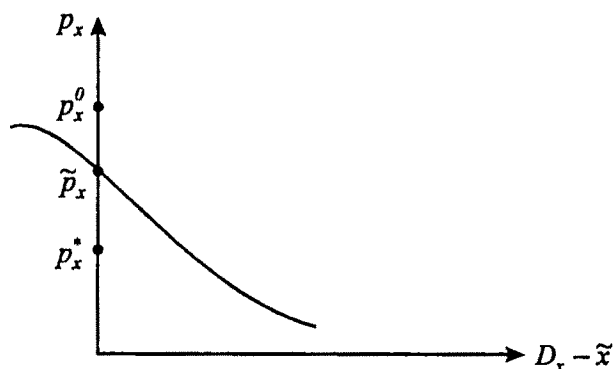


Figure IV

The optimal tariff (or equivalently, the optimal p_x) may be represented in figure V. Heuristically speaking, as p_x falls below \tilde{p}_x , output adjusts along the marginal cost curve; while as p_x goes up above \tilde{p}_x , output is adjusted along the demand curve. This heuristic argument, of course, ignores the fact that the demand curve shifts as employment changes. The following proposition summarizes our argument:

Proposition 2. *The optimal tariff is positive and is obtained at the point*

⁸ In this range, the tariff revenue is positive. However, we assume that the government does not spend the tariff revenue during the period under consideration.

where the marginal cost curve intersects the demand curve.

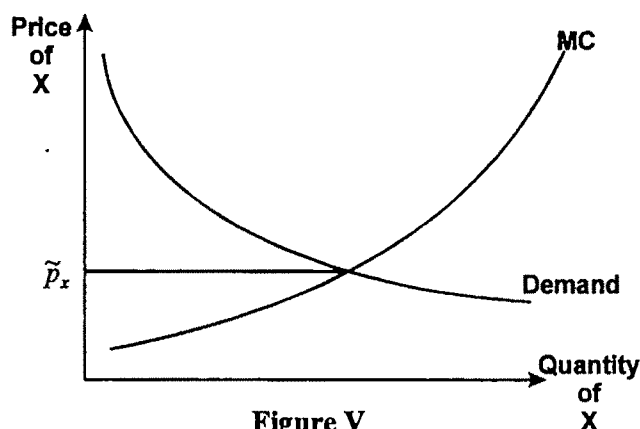


Figure V

Let us now consider the case of a country with a small domestic market. First suppose the domestic market is so small that at $p_x = p_x^*$, the country is a net exporter of x . In this case the optimal tariff is zero. For, in this case, as p_x falls from p_x^0 to p_x^* , all through employment remains the same but consumption of x and hence utility goes up due to the fall in p_x . If, on the other hand, at $p_x = p_x^*$, the country is a net importer of x , then a positive tariff is optimal and the preceding arguments regarding optimal tariff hold good.

Next we ask the question : how does the optimal tariff change with an inflow of foreign capital? Note that as K_x goes up, the marginal cost curve shifts out and as a result the curve $(D_x - \tilde{x})$ in figure IV shifts in. Thus, the optimal price \tilde{p}_x (and hence the optimal tariff) goes down. We thus have

Proposition 3. *Economic reforms leading to an inflow of foreign capital should optimally be accompanied with a fall in tariffs.*

The real implication of proposition 3 is that reforms to commodity trade and foreign capital inflow should be simultaneous and not sequential.

Finally, suppose that the tariff rate adjusts optimally as more foreign capital comes into the country. How far can this optimal adjustment arrest the fall in employment that takes place with an increase in K_x ?

Suppose K_x increases and we try to keep L_x constant by reducing p_x (i.e. by increasing the real wage). At unchanged L_x , domestic income remains constant; but due to the fall in p_x , D_x increases. Also due to the increase in K_x (at unchanged L_x), supply of x goes up. The new equilibrium is feasible if $\hat{x} \leq \hat{D}_x$. From the production function (2.5) we have

$$\hat{x} = K_x^\rho (L_x^\rho + K_x^\rho)^{-1} \hat{K}_x \quad (3.6)$$

On the other hand,

$$\hat{D}_x = -\hat{p}_x = \hat{MP}_L^x$$

where MP_L^x is marginal productivity of labour in x . From the production function, we get

$$\hat{D}_x = \hat{MP}_L^x = (1 - \rho) K_x^\rho (L_x^\rho + K_x^\rho)^{-1} \hat{K}_x \quad (3.7)$$

Comparing (3.6) and (3.7) we get $\hat{x} > \hat{D}_x$. Hence the equilibrium is not feasible. This implies that L_x cannot be kept constant by reducing p_x as K_x goes up. Can it be increased? Now $\hat{x} > \hat{D}_x$ implies that

$$p_x x - w L_x > p_y E(p_y) \quad (3.8)$$

At constant L_x and increased K_x , (3.8) must hold. If we want to increase L_x then p_x has to be increased (from the level which keeps L_x constant). This implies an increase in the left hand side of (3.8). On the other hand, as L_x increases, L_y and p_y go up leading to a fall in the right hand side of (3.8). Thus the discrepancy in the balance of payments increases and hence L_x cannot be increased. The above argument assumed that the marginal productivity of labour is equal to the real wage. If the marginal productivity of labour were greater, which is possible in the present model, the argument goes through with greater strength. Thus we may conclude that there is no possible p_x at which L_x can be kept constant or increased if there is an increase in K_x . Thus we have the following proposition:

Proposition 4. *Even if the rate of tariff is adjusted optimally, the level of employment goes down with an increase in foreign capital.*

The above proposition, of course, holds for 'large countries'. For small countries for which the optimal tariff is zero, an increase in foreign capital increases output and employment. Secondly, it follows from our analysis that for large countries if the tariff is adjusted optimally, the short run cost. (in terms of unemployment) of having economic reforms is somewhat reduced. It is clear that over time as K_x increases sufficiently, the country eventually becomes a net exporter of x and from that point on further increases in K_x unambiguously increases output and employment. The transition to such a state, however, is costly and optimal tariff adjustments reduce this cost.

3.3 Devaluation

We had so far assumed that the exchange rate is fixed and is normalized to be equal to unity. In this section, we look at devaluation as a third policy option open to the government. In particular, we analyse how devaluation may be combined with the other two policies, namely, the policy of bringing in more foreign capital and the policy of optimal tariff reduction, to ease the pains of structural adjustment. Since we shall be talking about devaluation, we rewrite the model explicitly bringing in the exchange rate.

Let e denote the exchange rate, i.e. the amount of domestic currency obtained for one unit of the foreign currency. Equilibrium in the y -market is then given by

$$A(p_y, L_x, e) = \alpha w L_x + p_y E\left(\frac{p_y}{e}\right) - (1 - \alpha) p_y y(p_y) = 0 \quad (3.9)$$

Consider first the case where the country has a large domestic market and does not export any x good. Then balance of payment equilibrium may be written as

$$B(p_y, L_x, e) = p_y E\left(\frac{p_y}{e}\right) - [p_x x - w L_x] = 0 \quad (3.10)$$

For any given e , the two variables L_x and p_y may be solved from (3.9) and (3.10). We want to find out the effects of devaluation, i.e. and increase in e .

Let us assume that the economy always adjusts its tariffs such that employment is maximized. This means that imports are zero and

$$p_x = e T p_x^* = c'(x) \quad (3.11)$$

This means that with devaluation as e changes, the tariff rate T is adjusted in such a way that (3.11) is satisfied. Thus we can rewrite (3.10) as

$$B(p_y, L_x, e) = p_y E\left(\frac{p_y}{e}\right) - \pi_x(L_x, K_x) \quad (3.12)$$

In view of (3.11) we have

$$\frac{\delta \pi_x}{\delta L_x} = c''(x) \frac{\delta x}{\delta L_x} > 0 \quad (3.13)$$

It is straight forward to verify from (3.9) and (3.12) that the partial derivatives $A_p < 0$, $A_L > 0$, $B_p < 0$, $B_L < 0$ and $A_e = B_e > 0$. Using Crammer's rule we get from (3.9) and (3.12):

$$\begin{aligned} \frac{dp_y}{de} &= -\frac{A_e(B_L - A_L)}{\Delta} \\ \frac{dL_x}{de} &= -\frac{A_e(A_p - B_p)}{\Delta} \end{aligned} \quad (3.14)$$

where $\Delta = A_p B_L - A_L B_p > 0$ by our assumption that the elasticity of demand for exports is greater than one.

Straight forward calculation yields that $\frac{dp_y}{de} > 0$, $\frac{dL_x}{de} > 0$. In other words, if tariffs are adjusted optimally, then a devaluation leads to an unambiguous expansion in employment and output in both sectors. The problem, however, is that it increases both p_y

and p_x (p_x increases because $c'(x)$ goes up in equilibrium) and hence reduces the real wage. Thus the policy of increasing employment through devaluation may not be feasible.

We have seen in section 3.1 that for this large economy, an increase in K_x reduces employment but increases real wage. A devaluation, on the other hand, has the opposite effects, i.e. it increases employment but reduces real wage. A reduction in real wage and a reduction in employment put independent pressures on the policy maker. Thus if inflow of foreign capital is combined with devaluation, both these pressures can be eased to some extent. The ultimate aim, of course, is to attract sufficient foreign capital so that the country becomes an exporter of x . This aim may be achieved with relatively less pain if the exchange rate is devalued by small amounts as and when new foreign capital comes in. The tariff rate has also to be adjusted optimally all along. Thus all three policy instruments have to be used simultaneously to make the reform process smooth and painless.

The effect of devaluation for a country with a small home market is more straight forward. Since, in this case, profit maximization in the x -sector implies

$$ep_x^* = c'(x + x^*) \quad (3.15)$$

an increase in e must increase L_x . On the other hand, this increase in L_x and the increase in the demand for exports of y due to the increase in e , both tend to increase the output, employment and price of y . The effect of devaluation in this case is shown in figure VI where the upward rising curve represents combinations of p_y and L_x which

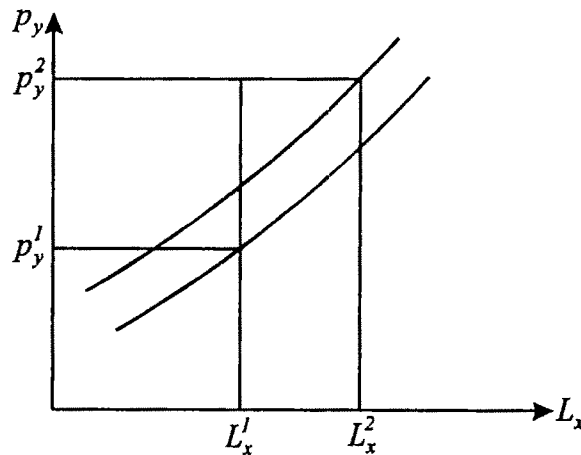


Figure VI

⁹ Note that in the case of a small country, optimal tariff implies $p_x = c'(x + x^*)$. Thus if K_x goes up, L_x , L_y also increase leading to a fall in the real wage.

keep the y-market in equilibrium i.e. satisfy (3.9). Equilibrium L_x is obtained from (3.15). An increase in e increases L_x and also shifts the upward rising curve to the left. Hence both p_y and L_x go up. Clearly, devaluation reduces real wage in terms of both goods⁹. We summarize our findings of this section in the following proposition :

Proposition 5. *Devaluation increases employment but reduces real wage. However, for a country with a large home market, the short run adverse effects of foreign investment can be reduced if it is combined with a devaluation and an optimal adjustment of tariffs.*

4. Concluding Remarks

In this paper we considered the short run effects of foreign investment in a demand constrained economy where some labour remains unemployed. We show that the effect on employment and output depends on the size of the domestic market. If the domestic market is large, foreign investment has an adverse effect. In this case, other accompanying policies, like devaluation or optimal adjustment of tariffs, will have to be adopted to ease the short run adverse effects. Thus, assuming that foreign investment is beneficial for the economy in the long run, in the short run other trade related reforms will have to be simultaneously introduced to make inflow of foreign investment feasible economically and politically.

In our model, we assumed that the quality goods are produced with foreign capital alone. We could, instead, have some domestic capital, along with foreign capital, producing x . This would not change our results. Similarly, our results will hold even if entire foreign profits are not repatriated. The same comment applies to joint ventures in the x sector where some profits are repatriated abroad. Thus our results seem to be somewhat robust and we think that they give important insights into the process of transition to free market economies for many underdeveloped countries.

References

- Basevi, Giorgio (1970) : 'Domestic Demand and Ability to Export', *Journal of Political Economy*, March / April, 330-37.
- Beladi, Hamid and Sugata Marjit (1992) : 'Foreign Capital, Unemployment and National Welfare', *Japan and the World Economy* 4, 311-317.
- Brecher, R. A. and C. F. Diaz-Alejandro (1977) : 'Tariffs, Foreign Capital and Immiserizing Growth', *Journal of International Economics* 7, 317-322.
- Brecher, R. A. and R. Findlay (1983) : 'Tariffs, Foreign Capital and National Welfare', *Journal of International Economics*, 14, 277-288.
- Dewatripont, M. and G. Roland (1995) : 'The Design of Reform Packages Under

- Uncertainty', *American Economic Review*, 85, number 5, 1207-1223.
- Gupta, S.P. and R.L. Chawla (editors) (1995) : 'Prospects of Foreign Direct Investment in India in Post Liberalisation Era', *Indian Council for Research on International Economic Relations*.
- Krugman, Paul (1984) : 'Import Protection as Export Promotion : International Competition in the Presence of Oligopoly and Economies of Scale', in H. Kierzkowski edited, *Monopolistic Competition and International Trade*, Oxford University Press.
- Lipton, David and J. Sachs (1990) : 'Creating a Market Economy in Eastern Europe : The Case of Poland', *Brookings Papers on Economic Activity*, 1, 75-133.
- MacDougall, G.D.A. (1960) : 'The Benefits and Costs of Private Investment from Abroad : A Theoretical Approach', *Economic Record* 36, 13-35.
- Marjit, Sugata and A. Sarkar (1995) : 'Protection and Exports : A theoretical Note', *Economic and Political Weekly*, Vol. XXX, No. 15, 809-810.
- Murphy, K, A Shleifer and R. Vishny (1992) : 'The Transition to a Market Economy : Pitfalls of Partial Reform', *Quarterly Journal of Economics*, August, 107(3), 889-906.
- Riedel, J.C. Hall and R. Grawe (1984) : 'Determinants of Indian Export Performance in the 1970s' *Weltwirtschaftliches Archiv*, 120, 40-63.
- Sachs, J. (1993) : 'Poland's Jump to the Market Economy', *MIT Press*.
- Sarkar, A. (1989) : 'A Keynesian Model of North-South Trade', *Journal of Development Economics*, 30, 179-188.
- Woo, Wing Thy, 'The Art of Reforming Centrally Planned Economies : Comparing China, Poland and Russia', *Journal of Comparative Economics*, June, 18(3), 276-308.

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